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# BRITISH JOURNAL OF TUBERCULOSIS AND DISEASES OF THE CHEST

Vol. XLVII.

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## THE CLINICAL APPRECIATION OF HARVEY'S DISCOVERY

BY PROFESSOR CHARLES SINGER

ALL know that modern experimental physiology began in 1628 with the publication of the demonstration by William Harvey that the blood circulates. This explanation of the behaviour of the heart, the vessels, and the blood seems evident to us nowadays. Why then were not such very simple experiments and observations as those of Harvey made by one of the many earlier anatomists and similar conclusions drawn? And why, having been made by Harvey, did not his scheme receive immediate universal consent?

The answer is not difficult. Before Harvey there was a very satisfying general physiological scheme in wide general acceptance by educated men. It had received formal expression by Galen, an Asiatic Greek physician practising in Rome under the Emperor Marcus Aurelius in the second century A.D. Galen's physiology was still quite adequate for the seventeenth century. Harvey's discovery was inconsistent with it, but Harvey provided no general physiological scheme. Thus Galen's physiological scheme continued in use at least until the eighteenth century, despite the fundamental difficulty raised by Harvey.

Briefly Galen's scheme is as follows: He considered that food, traversing the alimentary tract, is absorbed as chyle, collected by mesenteric vessels, and passed from them through the portal vein to the liver. There it is elaborated into venous blood and imbued with a spirit or *pneuma* that is innate in all living substance. This was the *natural spirit*. Charged with this and with nutritive materials, venous blood is distributed to the body by the vena cava, which was held to arise from the liver. The vena cava, according to Galen, runs the length of the body as a single vessel, giving off many branches by which nourishment is brought to the various organs. Since the nutritive content is burned up in the tissues, there is no need for a circulation.

A special significance is given by Galen to one great branch of the vena cava, namely that which we now call the "right ventricle." Its atrium is a mere safety pocket for overflow and therefore needs little discussion in the Galenic scheme. Some blood that enters the right ventricle ebbs back into the vena cava, but a certain small and very significant proportion does not return but is consumed in one of two ways:

(Received for publication September 23, 1952.)

- (a) Some passes from the ventricle into the "arterial vein" (our pulmonary artery) and so into the lung, when it is exhaled as "smoky" fumes. These give poisonous and suffocating properties to the breath. That is why an animal that cannot get fresh air soon dies. It was thought to poison itself with these fumes.
- (b) Some trickles through (imaginary) pores in the inter-ventricular septum into the left ventricle. There it meets air that comes via the "venous artery" (our pulmonary vein) from the lung which it reaches from the outer world. This air, or the *pneuma* in it, acting on the *natural spirit* in the blood that has traversed the septum, converts it into a higher form of *pneuma*, the *vital spirit*. This is distributed to the organs by the arterial blood.

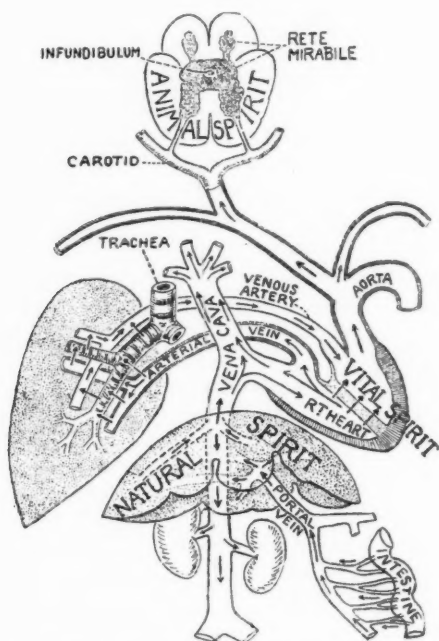


FIG. 1.—Diagram illustrating Galen's physiological scheme.

Reproduced from Singer and Rabin, "A Prelude to Modern Science," Publications of the Wellcome Historical Medical Museum, new series, No. 1.

Some of the vital spirit is brought to the brain by the carotids. These, on entering the cranial cavity, divide into minute vessels to form, around the pituitary, the "wonderful network," *rete mirabile*, a structure found especially in ungulates, on which Galen based his physiology, though not in man. Here in the *rete* the vital spirit is transformed into *animal spirit*. This is distributed by the nerves to the various parts of the body, and is responsible for all forms of nervous activity, both motor and sensory.



This scheme is consistent, simple and comprehensive. It provided a very fair background to medical practice for which Harvey's discovery was, at first, of little or no clinical value by itself. Nor could Harvey's discovery be of clinical use until given fuller expression by the publication of the work of the Rev. Stephen Hales almost exactly a century later. Moreover Galen's physiological views were intimately linked with the theory of the four humours. This last view of the nature of the living body was not completely abandoned until a century ago and still survives in our nomenclature of the "temperaments," as "sanguine," "phlegmatic," "choleric" and "melancholic," corresponding to supposed excess of blood, phlegm, "yellow" bile, and "black" bile.

Before ending it is worth emphasising here a special difference, that is frequently missed, between Harvey's view and the earlier scheme. It is *quantitative* whereas Galen's is not. By the anatomists before Harvey the idea that the blood *irrigates* the tissues is repeatedly stressed. Now in irrigation water is led into the field which is so channelled that it seeps into the earth, dampening it. The growing corn absorbs it and that part not so absorbed is evaporated. With that view Harvey began and that was still the view of some of his early followers such as Descartes, author of the first book devoted solely to physiology. But Harvey, having determined the course of the blood in the heart itself from the construction of the cardiac valves, measured the capacity of the ventricles. He estimated that of each at 2 oz. Now if the heart beats seventy-two times a minute, then in an hour the left ventricle will throw into the aorta about 38 stones 8 lb. of blood, about three times the body weight of a heavy man. Where can all this come from? Where can it all go to? It cannot remain in the tissues. We have here to do not with seepage but with a mighty torrent. When this point was adequately brought out by Hales, then—but not till then—the conception of the circulation of the blood became of clinical instead of only scientific importance.

## THE EPIDEMIOLOGY AND PREVENTION OF TUBERCULOSIS IN CORNWALL \*

By E. R. HARGREAVES

From the Public Health Department, County Hall, Truro

### INTRODUCTION

DURING the past quarter of a century the respiratory tuberculosis death rate in Cornwall has consistently been below that of England and Wales, but any sense of complacency is quickly dispelled when one studies Cornish mortality rates with a comparable area such as the south-western counties; the average mean mortality rates for the three-year period 1946-48 inclusive for Cornwall and for the administrative counties of Cornwall, Devon, Dorset, Somerset and Gloucester, are shown in Table I.

TABLE I.—TUBERCULOSIS MORTALITY RATES 1946-48  
S.-W. Counties—Average Mortality per 1,000 Population

<i>Tuberculosis</i>	<i>Western Counties</i>	<i>Cornwall</i>
All forms .. .. .	0.441	0.491
Pulmonary .. .. .	0.365	0.389
Non-pulmonary .. .. .	0.076	0.102

The fight against tuberculosis is one of the major tasks of preventive medicine. The following paper deals with measures taken in Cornwall during the past two years.

### TOPOGRAPHY OF CORNWALL

The county of Cornwall is a peninsula with sea on three sides, a feature which has given Cornwall its maritime history and one of its main industries, namely, fishing.

Inland, the most striking features are the rugged granite bosses which form the upland area of the county. These granite outcrops, which rise to a height of 800 to 1,200 feet, are in four groups—namely, Bodmin Moor, St. Austell, Redruth and St. Just. It is to them that the county owes its other staple industries, mining, china clay and quarrying. The history of Cornish mining is extremely old, trade being carried on with the Phoenicians 3,000 years ago. The latter part of the nineteenth century saw the industry at its peak: in 1870, the miners numbered more than 50,000, and the population of the county was 370,000. At this time, 40 per cent. of the world's tin was being produced in Cornwall from the 340 mines then working, but before the end of the century exhaustion of the more accessible lodes, combined with the advent of cheap alluvial tin from Malaya, killed the industry. In 1950 the

\* This paper is abridged from an N.A.P.T. prize essay.

(Received for publication, June 11, 1953.)

FIG. 1.

population of the county was 340,000, of which approximately 200 were employed in the four mines which remain active.

This rapid decline in mining left behind derelict areas and unemployment. In the Camborne-Redruth area this has been mitigated by the manufacture of mining equipment, and the St. Austell area by the china clay industry, but in St. Just unemployment and depopulation have persisted.

#### EPIDEMIOLOGY

From what has been said of the topography of Cornwall one would expect to find the incidence varying considerably within the county. A map showing mortality rates in local authority areas illustrates the relative freedom from the disease of most of the county, together with the high mortality rate in the derelict mining area of St. Just and, to a lesser extent, the Camborne-Redruth area.

As available personnel, equipment and sanatoria beds precluded a county-wide campaign, it was decided, whilst in no way relaxing routine work in other areas, to concentrate our resources where the incidence was highest, extending the work to adjacent areas as opportunity offered. The attack would follow the normal epidemiological approach to any infectious disease, namely:

- (i) A careful assessment of the general environmental conditions and the incidence of the disease in the area under consideration, together with the uncovering of cases not notified.
- (ii) The determination of the source of infection of individual cases, and the isolation, education and treatment of cases and sources so found.
- (iii) The protection of susceptible members of the population exposed to infection and the improvement of the environment in which they live.

#### ADMINISTRATION

The county is divided into seven areas, each under the control of a full-time Medical Officer of Health who is also an Assistant County Medical Officer. The population of each of these areas is approximately 50,000. The County Medical Officer holds a quarterly meeting of the Assistant County Medical Officers, and once a month the County Medical Officer or his representative meets the chest physicians in order to smooth out any difficulties which may arise.

There are seven tuberculosis health visitors, each based on a chest clinic area and responsible for the running of the clinic, domiciliary visits to patients, tuberculin testing of contacts, and segregation of tuberculin-negative contacts where B.C.G. is thought advisable.

A special contact and B.C.G. clinic is held once a month in all areas and an effort is being made to ensure that all tuberculin-negative contacts under 40 years of age receive B.C.G.

The number of visits of contacts to the clinic is reduced to a minimum. The health visitor applies a tuberculin jelly test prior to the first visit. Positive reactors have an X-ray; if the test is negative and the chest physician advises B.C.G., the health visitor arranges segregation and subsequently carries out

a Mantoux test three days prior to the next visit to the clinic. The test is read by the chest physician who carries out B.C.G. vaccination. In this way vaccination is carried out at the second attendance.

Segregation of the contacts for six weeks before and six weeks after vaccination is rigidly enforced. Where no relative is available, the child is admitted by the Children's Officer to one of her homes. Babies born of tuberculous parents are vaccinated within a few days of birth and placed under the Children's Officer for six weeks.

The response to B.C.G. vaccination has been good; up to June 30, 1952, 720 vaccinations have been carried out, and in three of the seven areas of the county all contacts have now been protected.

#### SPECIAL MEASURES

##### *Investigations at St. Just, 1950-51*

The urban district of St. Just, which has a population of 4,076, is divided into two wards—St. Just Churchtown (population approximately 2,500) and Pendeen Ward (population approximately 1,500). The former consists of the town of St. Just and the latter of little clusters of houses (Carnyorth, Trewellard, Pendeen and Bojewan) which straddle the main road as it passes north along the coast towards St. Ives. The town of St. Just, once a prospering mining centre, has now no staple industry. A hundred years ago the urban district contained sixteen active mines, some working the rich lodes of tin which run through this granite outcrop, others the copper which lies in the beds of shale running under the sea. The headgears of these latter mines can still be seen perched on the precipitous cliffs, and one is reminded of the enterprise and courage of the Cornishmen who sunk and worked the mines.

The galleries ran very close to the sea bed. Pryce states: "At Wheal Cock, they have only a crust between them at most; and though, in one place, they had barely four feet of stratum to preserve them from the raging seas, yet they have rarely more than a dribble of salt water which they occasionally stop with oakum or clay inserted in the crannies through which it issues."

Henwood gives an interesting account of a visit to the same mine, Wheal Cock, in 1843 during a storm: "When standing beneath the base of the cliff and in that part of the mine where but 9 feet of rock stood between us and the ocean, the heavy roll of the large boulders, the ceaseless grinding of the pebbles, the fierce thundering of the billows, with the cracking and boiling as they rebounded, placed a tempest in its most appalling form too vividly before me to be ever forgotten."

To return to modern St. Just, the houses are sturdily built in granite but are small, and as there is little natural shelter from the Atlantic gales the west walls are devoid of windows. One tin mine is still working at Pendeen and some of the men who live in this part of the urban district are employed there.

The tuberculosis register contains 54 names in the St. Just urban district, 46 being pulmonary cases and 8 non-pulmonary.

The homes of these patients were visited and in each case a brief appreciation made of the home conditions to decide, where possible, the source of infection and necessary action.

The source of infection was discovered in 34 (74 per cent.) of the 46 cases of pulmonary tuberculosis; a parent being the source of half the cases, a sibling in 22 per cent., some other relative in 15 per cent. and a friend in 13 per cent. Only one instance of conjugal infection was recorded. Three of the untraced cases had developed the disease in the Services.

The incidence of disease through the area was not even. The figures for the two wards being:

		<i>Population</i>	<i>No. of cases</i>	<i>Incidence per 1,000</i>
St. Just Churchtown .. ..		2,500	19	7.60
Pendeen .. ..		1,500	35	23.30

#### TUBERCULIN TESTING

A tuberculin test was offered to all children attending schools in the area, the response was excellent, 92 per cent. accepted.

Tuberculin jelly was used, as advocated by Pointon Dick. To ensure uniformity, the application and reading of the tests was done by a team of one health visitor and two doctors. Positive reactors were graded according to sensitivity into + (slight), ++ (moderate), and +++ (severe).

TABLE II.—RESULT OF TUBERCULIN TESTS

<i>Age (years)</i>	<i>St. Just Churchtown</i>		<i>Pendeen</i>		<i>Total St. Just (U.D.C.)</i>	
	<i>No. tested</i>	<i>Positive per cent.</i>	<i>No. tested</i>	<i>Positive per cent.</i>	<i>No. tested</i>	<i>Positive per cent.</i>
5-6 .. ..	25	26	31	26	54	25
7-8 .. ..	47	38	34	58	81	47
9-10 .. ..	61	33	38	58	99	42
11-12 .. ..	59	49	20	55	79	50
13-14 .. ..	72	50	9	66	81	56
15 and over ..	39	51	12	58	51	54

The results are shown in Table II and Fig. 2. No correlation was found between the degree of sensitivity and subsequent X-ray findings. It is interesting to note the consistently higher spontaneous conversion rate in children of the Pendeen Ward than in those of St. Just Churchtown.

#### MASS RADIOGRAPHY

A mass radiography survey of the district was carried out in February and early March. In addition to the usual publicity methods, a local committee was formed, consisting of two general practitioners, the district nurse and twelve lay members. A house-to-house canvass was organised by the committee. I am indebted to Dr. Geoffrey Sheers for permission to publish his figures. Table III shows the response and Table IV the significant results.



Among the inactive groups are included many small calcified foci of no clinical significance.

TABLE III.—RESPONSE TO MASS RADIOGRAPHY

<i>Group</i>	<i>Totals</i>	<i>No. available*</i>	<i>No. radiographed</i>	<i>Per cent. radiographed</i>
Schoolchildren .. ..	524	365	294	80.54
Geevor Mine .. ..	310	310	216	69.67
St. Just U.D.C. (totals) ..	4,093	3,615	1,611†	44.50

\* 105 were X-rayed at hospital.

† 319 children under 5, and 159 tuberculin-negative schoolchildren aged 5-11, were excluded.

TABLE IV.—CASES FOUND

<i>Pulmonary tuberculosis</i>	<i>No. of cases</i>	<i>Incidence per 1,000 examined</i>
Active .. ..	12	7.9
Observation .. ..	13	8.6
Inactive .. ..	171	113.0
Silicosis .. ..	31	20.6

#### B.C.G. VACCINATION

B.C.G. vaccination was offered to tuberculin-negative children in the area. The response was good: 82 per cent. accepted, 6 per cent. refused, and 12 per cent. did not reply to my letter. Vaccination has so far been limited to contacts of known cases and school leavers.

#### ST. JUST, 1952

The mass radiography unit revisited St. Just a year later. During a two-day visit, all school leavers passed through the unit together with 8 tuberculin-positive reactors found in the year's school entries. Two open sessions were held for the general public.

In all, 222 people were X-rayed, 2 significant primary cases, 4 inactive primary and 4 cases of silicosis were found.

Of the 8 tuberculin-positive school entrants, 6 were found to have contact with known cases of pulmonary tuberculosis, and the X-ray of 1 of these 6 showed clinical pulmonary tuberculosis.

#### INVESTIGATION AT PENRYN

Penryn was chosen as the next area on which to concentrate, as it was of similar size to St. Just, the population was compact and easy to reach, it had the second highest incidence of tuberculosis in the county and, perhaps the most important, it has a very strong civic sense.

Lying two miles farther up the river than Falmouth, it was at one time a flourishing port. Today the male population is, in the main, employed at Falmouth docks, though a few work in the neighbouring granite quarries.

The preliminary work carried out was on similar lines to St. Just. A visit was paid to the houses of the 50 cases on the tuberculosis register (36 pulmonary, 14 non-pulmonary), to ascertain home conditions and, where possible, the source of infection.

The probable source was identified in 20 (55 per cent.) of the pulmonary cases, a parent being responsible in 7 instances, a sibling in 4, some other relative in 6 and a friend in 3. There were 2 instances of conjugal infection.

Of the 16 cases in which no source could be identified, 6 developed the disease in the Services.

#### TUBERCULIN TESTS

A tuberculin test was offered to all schoolchildren and, as at St. Just, an excellent response resulted, the figure being 92 per cent. accepting.

#### TUBERCULIN TESTS — ST. JUST

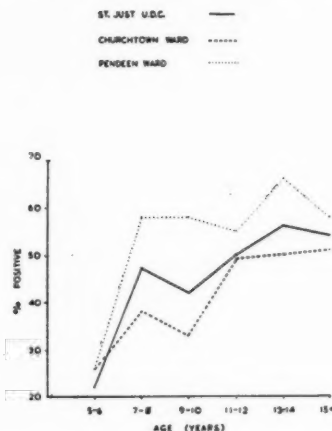


FIG. 2.

The results are summarised in Table V. It will be noted that the conversion rates in Penryn schoolchildren are considerably lower than those recorded at St. Just.

#### MASS RADIOGRAPHY

A survey was carried out from February 14 to March 12, 1952.

Propaganda followed the same lines as that used at St. Just, except that the house-to-house canvass was carried out by health visitors. It was also agreed to X-ray the public without requesting them to undress, a fact much appreciated by them and allowing of mixed sessions.

The number attending was as follows:

					Morning	Afternoon	Evening
Sessions	..	..	..	..	4	11	11
Attendances	..	..	..	..	526	962	1,034

The majority of those attending the morning sessions were schoolchildren.

The results of the Penryn survey are shown in Table V. For purposes of comparison of tuberculosis rates, tuberculin sensitivity and mass radiography, findings at both St. Just and Penryn are included.

TABLE V

	<i>St. Just</i>		<i>Penryn</i>		<i>Cornwall</i>
Population .. .. .	4,093		4,103		339,800
<i>Tuberculosis rates:</i>					
Incidence—all forms .. ..	13.41		12.19		6.19
"    pulmonary .. ..	10.99		8.78		4.94
"    non-pulmonary .. ..	2.42		3.41		1.25
Mortality—all forms .. ..	1.23		0.67		0.50
<i>Tuberculin testing in schools</i>					
Positive reactors:	<i>No. Tested</i>	<i>Per cent. positive</i>	<i>No. tested</i>	<i>Per cent. positive</i>	
5-6 .. .. .	54	25	57	11	
7-8 .. .. .	81	47	99	13	
9-10 .. .. .	99	42	99	17	
11-12 .. .. .	79	50	83	27	
13-14 .. .. .	81	56	57	23	
15+ .. .. .	51	54	23	43	
<i>Mass Radiography:</i>					
General population percentage X-rayed .. .. .	44.5%		43.5%		
Schoolchildren percentage X-rayed .. .. .	80.5%		88.0%		
<i>Significant findings</i>					
	<i>No.</i>	<i>Rate per 1,000 examined</i>	<i>No.</i>	<i>Rate per 1,000 examined</i>	
Pulmonary tuberculosis active ..	12	7.9	1	0.6	
"    "    observation ..	13	8.6	5	3.0	
"    "    inactive ..	171	113.0	37	24.4	
Silicosis .. .. .	31	20.6	4	2.4	
Carcinoma .. .. .	—	—	1	0.6	
Bronchiectasis .. .. .	2	1.3	4	2.4	
Cardiovascular conditions .. ..	7	4.6	2	1.2	
Other conditions .. .. .	25	16.5	6	3.6	

### Discussion

The most important measures in the prevention of tuberculosis are the control of known cases and the finding of unknown sources of infection.

A careful search for the origin of infection of each case, although time-consuming, must remain the keystone of this work. Investigation at St. Just and Penryn resulted in the source of infection being traced in two out of every three cases. Mass radiography is a valuable adjunct, but it is difficult to keep so large a unit fully employed in a rural county: consideration might well be given to the 70 mm. camera unit with a staff of only three as at present in use in Ireland.

The surveys at St. Just and Penryn occupied the unit for five and four weeks respectively. The examination rate averaged 630 per week, or approximately three-quarters of the rate usually worked in factory or city, but many more large films were taken, as all the tuberculin-positive children under 11 years of age had large films.

The response of the general public at St. Just, of whom only 44 per cent. attended, was disappointing, but, subsequent work at Penryn, where slightly different methods were employed with identical results, showed that it is not possible to get more than 50 per cent. of the general public through the unit with economy. Nevertheless, much was achieved. We know the location of many of the dangerous sources of infection; we have an X-ray record of the school population, together with a record of their tuberculin reactions.

A yearly visit is now made at which all school entries and leavers are

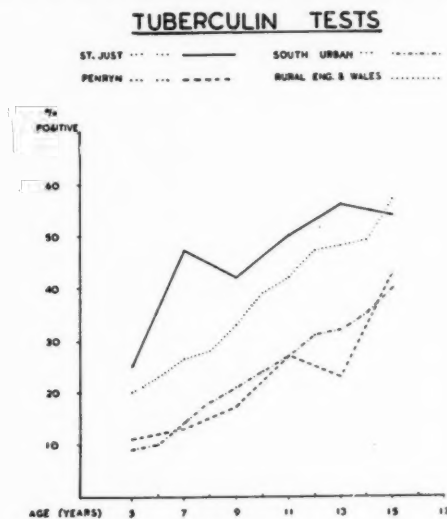


FIG. 3.

tuberculin tested, positive reactors being X-rayed and negative reactors amongst school leavers offered B.C.G. vaccination.

The tuberculin sensitivity rates for Penryn and St. Just are shown on a graph (Fig. 3), together with the findings of the Medical Research Council National Tuberculosis Survey. The Cornish figures are insufficient to give a smooth curve, but, nevertheless, the St. Just results compare closely with the Medical Research Council's findings in rural districts and the Penryn findings with the figures for south urban districts. Marc Daniels believed that the differing rates are due largely to milk supplies, the urban districts being largely pasteurised, and this is supported by Coutts, who found that the rate for the rural district in Cambridgeshire was 20 per cent. above that for the City of Cambridge. A similar explanation is possible in Cornwall, as the Penryn milk supply is almost entirely pasteurised, whereas in St. Just it is for the most part raw milk, but a more probable explanation is the heavy incidence of pul-

monary tuberculosis in St. Just as compared with Penryn. This explanation is supported to some extent by the fact that in St. Just, where the population is conveniently split up into two geographically distinct wards which vary markedly in the incidence of tuberculosis, the tuberculin sensitivity amongst the schoolchildren was found to follow very closely the incidence of the disease.

### Summary

As limitation of personnel, equipment and beds precludes intensive anti-tuberculosis measures on a wide front, it was decided, whilst in no way relaxing the general methods in use throughout the county, to concentrate on particular local authority areas where the incidence was high. An account is given of the activities in the first two areas to be tackled—namely, St. Just and Penryn urban districts.

A careful search revealed the source of infection in two out of three cases. Despite publicity and house-to-house canvassing, less than 45 per cent. of the general public attended the mass radiography unit. It is doubtful whether it is justifiable to employ so large a unit on such work as, owing to the scattered nature of the population, the unit can only work two-thirds of its capacity. Consideration should be given to the smaller type of unit fitted with a 70 mm. camera as in use in Ireland.

Schoolchildren in the areas have received tuberculin tests, positive reactors passed through the mass radiography unit and negative reactors given B.C.G. vaccination. This work is being continued by a yearly visit to the schools during which all school leavers in the current year, and all school entries since the last visit, are tuberculin tested and subsequently dealt with as above.

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## ARTIFICIAL PNEUMOPERITONEUM IN THE TREATMENT OF PULMONARY TUBERCULOSIS

### A LATE FOLLOW-UP OF 101 PATIENTS

By J. R. EDGE

From the Red Cross Sanatoria of Scotland

In the last decade there has been a steady increase in the use of artificial pneumoperitoneum (hereafter referred to as "P.P.") in the treatment of pulmonary tuberculosis; Drolet (1951), describing treatment in a particular group of hospitals in the United States, points out that whereas in 1945 546 P.P.'s were induced, in 1951 the corresponding number was 31,035.

The present writer has been able to discover only one paper (Crenshaw and Gross, 1952), in which a late follow-up of the results of this treatment is described. These authors consider that at the present day P.P. is the minor collapse treatment of choice.

In view of the scarcity of evidence concerning the long-term effectiveness of this form of therapy, it was believed to be of value to present the results in a group of 101 patients, all treated under the care of one physician in one hospital, and reviewed from four to nine years after P.P. induction.

#### MATERIAL

Between February 1943 and December 1948 artificial pneumoperitoneum was induced in 109 patients, of whom the first 74 were described by Keers (1948). There were 4 inductions in 1943, 12 in 1944, 15 in 1945, 15 in 1946, 27 in 1947 and 36 in 1948, and the patients have been reviewed in December 1952, giving a follow-up period of from four to nine years.

#### CHEMOTHERAPY

The problem of assessing the effect of collapse treatment has been further complicated in the last few years by the introduction of chemotherapy. In this series only eight patients received chemotherapy in addition to the P.P. during their initial stay in hospital; these have been excluded from the analysis, leaving a total of 101 patients (84 men and 17 women) treated by P.P. for periods of from four months to over eight years.

#### METHOD OF FOLLOW-UP

The follow-up was conducted by writing in the first place to the individual patients; no further enquiry was made in the case of those who reported that they were well and able to work full time. Only in the event of a patient reporting any impairment of health, or working capacity, or in the event of no reply being received, was a further enquiry sent to the chest physician in charge of the case. It is felt that no significant error has been caused by using this technique.

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## PHRENIC CRUSH

The phrenic nerve was crushed in 100 of the 101 patients (right side, 48; left side, 47; each side in turn, 5). Recrushes were done on 13 occasions (right side, 6; left side, 7).

## COMPLICATIONS

Two of the 101 patients died from complications of pneumoperitoneum (air embolism, 1; acute tuberculous peritonitis, 1) and refills were discontinued prematurely, because of complications, in a further 7 (peritoneal effusion, 2; appendicitis, 1; hepato-diaphragmatic adhesions, 4). Other complications occurred but were unimportant.

*Air Embolism.*—An air embolism, with loss of consciousness but subsequent complete recovery, occurred in one patient during his initial stay in hospital; a second patient suffered a fatal air embolism after discharge.

*Peritoneal Effusion.*—This was observed in 9 patients. In 6 it did not interfere with treatment; in 2 it was large and persistent and the P.P. was therefore abandoned; and 1 patient died three months after induction from acute tuberculous peritonitis.

*Appendicitis.*—Two patients were operated on for acute appendicitis during P.P. treatment. In one of them the P.P. was re-induced three weeks after operation, and refills were continued without further incident.

*Hepato-diaphragmatic Adhesions.*—Adhesions were associated with failure to obtain a satisfactory rise in the diaphragm on four occasions, and the P.P. was discontinued in each case.

*Bowel Puncture.*—This occurred on one occasion, and was followed by the passage of flatus.

*Mediastinal Emphysema.*—This was noted on one occasion only, and was of mild degree.

## RESULTS

The sputum was positive on direct examination on admission in 94 patients, positive on culture only in 1 patient, and negative by both methods in 6, whilst cavitation was present in 75 patients before pneumoperitoneum induction.

Twenty-five of the 101 patients are dead, 17 have remained well after treatment by P.P. only, 43 are well after additional treatment, 5 are still undergoing treatment in hospital, and 11 are chronic open cases because further active treatment was not possible or was refused. No patient has been lost sight of.

The patients have been divided into three groups, according to the immediate response to P.P. treatment. The later results are then described for each group separately, together with any further treatment given.

*Group I* (25 patients), in which P.P. and phrenic crush was the only treatment used, apart from rest and routine sanatorium measures, and in which the results were considered to be satisfactory; the disease was quiescent at the time of discharge in each case.

*Group II* (41 patients), in which P.P. and phrenic crush was the initial treatment used and definite radiological improvement followed, but in which the result was not considered to be satisfactory and further active treatment was therefore advised.

*Group III* (35 patients), in which there was no very definite evidence that the P.P. had any beneficial effect on the course of the disease.

#### SITE OF LESION

The main lesions were almost evenly distributed over the 101 cases, between the upper, middle and lower zones of the lung fields. There was no evidence that P.P. is more effective for lesions in one zone than another.

#### GROUP I (25 PATIENTS)

Before treatment the sputum was positive direct in 21 patients and negative in 4, whilst there was obvious cavitation in 11 and none in 14.

The initial results were considered to be satisfactory. In all cases the sputum was repeatedly negative on direct examination, and there was no evidence of cavitation on the straight film at the time of discharge from hospital (see Table I). No further collapse measures were advised at that time.

(Three of the patients had had an artificial pneumothorax induced shortly before the pneumoperitoneum; in each case it was abandoned after a few refills because of extensive adhesions, without any apparent effect on the lesion.)

*Results of Follow-up.*—At the end of the follow-up period, 15 patients have remained well and 9 have relapsed, of whom 2 died of progressive tuberculosis (see Table II). The remaining patient died in an accident.

Of the remaining 7 relapsed patients, 3 are chronic open cases, 1 is still being treated in hospital, and 3 are well after further treatment (thoracoplasty 1, rest 2).

*Minimal Lesions.*—All the 6 patients who had minimal radiological lesions, according to the Prophit Survey definition, are in this group. Five of them remained well and 1 deteriorated; in this case there was an extraneous factor, the P.P. having been given up prematurely because of an unwanted pregnancy.

*Duration of P.P.*—Refills were maintained for an average period of two years nine months (five months to eight and a half years) in those patients who remained well; and for an average of two years one month (six months to five years) in those who relapsed.

One patient relapsed sixteen months after induction while the P.P. was still being maintained. The remaining eight did so within a few months of refills being discontinued (from three to eight months, an average of five and a half months). It is unlikely that this was a coincidence in each case, and it seems reasonable to infer that, when a satisfactory initial response to P.P. is obtained, the chances of permanent healing would be greater if refills were to be maintained for a longer period (*e.g.*, three to five years) than in the present series.

#### GROUP II (41 PATIENTS)

These patients had, as a group, more advanced disease than those in Group I. Before treatment the sputum was direct positive in 39 patients and negative in 2, whilst there was obvious cavitation in 33 and none in 8 (see Table I). There were no minimal lesions.

After treatment by P.P. and rest, the sputum became negative in about one-half (20 patients), while cavity closure as judged from the straight X-ray was observed in only 13. In all cases there was radiological evidence of improvement, either hardening and contraction of infiltrative lesions, or reduction in the size of cavities, or both; the disease was not considered to be adequately controlled, however, and further collapse treatment was therefore advised. The results are given in Table II.

Of the 41 patients, 30 have subsequently remained well, 8 have relapsed, and 3 are dead. In 16, after treatment with P.P., the disease was apparently quiescent, the sputum being negative and there being no obvious cavity. In spite of this encouraging start, further collapse was carried out (A.P. 9, thoracoplasty 7), and only 2 of these patients have relapsed.

#### *Further Collapse Measures (Table II)*

##### *1. Thoracoplasty*

Thoracoplasty was carried out on 21 patients, of whom 17 have since remained well, 2 died post-operatively, and 2 relapsed later.

Both the last are now well and working following further treatment, but 1 still has an occasional positive sputum nine years after diagnosis.

##### *2. Artificial Pneumothorax*

Sixteen patients were treated by artificial pneumothorax in addition to the P.P.; 11 of these have since remained well, 4 relapsed later, and 1 died from acute leukaemia.

Of those who relapsed, 1 is now well after a thoracoplasty, 2 are in hospital for surgery at the time of the review, and 1 is slowly deteriorating radiologically after refusing surgical treatment.

##### *3. Other*

Two of the remaining 4 patients remained well and 2 relapsed but are now well after further treatment.

Of 2 patients treated by thoracoplasty with contralateral A.P., 1 relapsed but is well after chemotherapy. One patient treated by extrapleural pneumothorax later broke down on the other side and is now well after thoracoplasty; and 1 patient for whom thoracoplasty was strongly indicated but not carried out because he was psychologically unsuitable eventually closed his cavity after the P.P. had been maintained for four years.

In 8 patients from this group P.P. with phrenic crush was used to control a lesion on one side, whilst other measures (artificial pneumothorax 5; thoracoplasty 3) were used for the other. Only 1 of these patients has relapsed.

In this group of 41 patients there have thus been no deaths due to progressive tuberculosis; 8 relapsed following discharge from hospital, and there were 2 post-operative deaths. These results compare favourably with those obtained in Group I (treated by P.P. alone), particularly as the type of disease was more advanced in Group II.

## GROUP III (35 PATIENTS)

This group contains a high proportion of patients with advanced disease; 16 had bilateral cavitating tuberculosis, and in 17 cases the P.P. was used in an attempt to supplement or replace unsatisfactory artificial pneumothorax, induced in most instances in the presence of active tuberculous endobronchitis (as evidenced by persistent cavitation, atelectasis and massive effusion, in various combinations). The majority of these A.P.s were carried out on relatively acute cases with extensive lesions, because no more satisfactory treatment was available at that time.

There was obvious cavitation before treatment in 31 patients, and evidence of closure after P.P. in only 2, both of whom deteriorated rapidly in other respects. Similarly, the sputum was positive in 34 patients, and became negative after P.P. in only 2, and both of these later broke down (see Table I).

*Deterioration following Induction of P.P.*—This group included the only patient in the series whose disease deteriorated shortly after the P.P. was started; a left apical tension cavity increased steadily in size in the months after induction, but was later closed after thoracoplasty.

*Results of Follow-up.*—Of the 35 patients, 19 are dead, 9 are alive and well, and 7 have relapsed. The results are shown in Table III.

Of the 9 who are alive and well, 6 were treated by thoracoplasty, 2 by artificial pneumothorax, and 1 recovered after prolonged bed rest only, the P.P. having been given up as ineffective after four months. All the relapsed patients are now chronic open cases, except for 1 who is well after recent decortication and upper lobectomy.

In this group of advanced cases there is no evidence that P.P. had any effect on the course of the illness; as might be expected, those cases who were able to be submitted to major surgery did best. Only 2 patients of 17 with artificial pneumothorax remain well, and each of these had a massive pleural effusion resulting in very effective and permanent collapse of the affected lung, and which did not, fortunately, proceed to empyema formation. In 3 others there was transient radiological improvement after P.P. induction, but no apparent effect on the overall course of the disease.

## Conclusion and Summary

The results of treatment, in one hospital, of 101 patients by artificial pneumoperitoneum have been reviewed between four and nine years after induction. None of these patients was treated by chemotherapy, except in a few instances for late relapse after leaving hospital. They are divided into three groups according to the results obtained from P.P. treatment, and any further treatment given is briefly described.

Of 25 patients in whom quiescence was achieved following P.P. alone, no less than 9 have broken down and required readmission to hospital. Eight of the relapses occurred shortly after refills were discontinued, after an average period of two years. Five of six patients in this group who had minimal disease have remained well.

Of 41 patients with more advanced disease, in whom improvement occurred following P.P., but for whom further collapse measures were nevertheless advised, 8 subsequently relapsed. Taking the more advanced type of disease into account, the results in this group compare very favourably with those in Group I.

From the experience of these 66 patients it appears that, whilst P.P. has a very definite place in the preparation of patients for more radical measures, in the long run if used alone it is likely to carry a substantial relapse rate, except perhaps in the case of early lesions.

There is evidence to suggest that if reliance is to be placed on P.P. alone, then refills should be continued for a period considerably in excess of two years.

There was no evidence, from observation of a further 35 patients, that P.P. has any very definite effect on the course of advanced pulmonary tuberculosis.

TABLE I

NUMBERS OF PATIENTS WITH EVIDENCE OF CAVITATION, AND WITH POSITIVE SPUTUM, IN EACH OF THE THREE GROUPS, BEFORE AND AFTER TREATMENT BY PNEUMOPERITONEUM

	<i>Total</i>	<i>Number with patent cavity before P.P.</i>	<i>Number in which cavity closed during P.P. treatment</i>	<i>Number with positive sputum before P.P.</i>	<i>Number in which sputum became negative during P.P. treatment</i>
Group I ..	25	11	11	21	21
Group II ..	41	33	13	39	20
Group III ..	35	31	2	34	2
Total ..	101	75	26	94	43

TABLE II

RESULTS IN PATIENTS IN GROUPS I AND II AT THE TIME OF THE REVIEW, FROM FOUR TO NINE YEARS AFTER INDUCTION OF P.P.

	<i>Additional collapse advised</i>	<i>Total</i>	<i>Alive and well</i>	<i>Relapsed</i>	<i>Dead</i>
Group I: pneumoperitoneum with phrenic crush only	Nil	25	15 (60%)	9* (36%)	3 (tbc: 2) (non-tbc: 1)
Group II: pneumoperitoneum with phrenic crush; further collapse measures advised	Thoracoplasty	21	17	2	2 (post-operative)
	A.P.	16	11	4	1 (non-tbc)
	Other	4	2	2	—
	Total	41	30 (73%)	8 (19%)	3

\* Including the two who died of tuberculosis.

RESULTS IN GROUP III AT THE TIME OF REVIEW SHOWING THOSE TREATED BY P.P. WITH PHRENIC CRUSH ALONE, AND BY ARTIFICIAL PNEUMOTHORAX OR MAJOR SURGERY IN ADDITION

PROPHET TUBERCULOSIS SURVEY (1948): "Tuberculosis in Young Adults," 1935-44 Survey, p. 175. Lewis, London.



## NON-OPAQUE FOREIGN BODIES IMPACTED IN THE GLOTTIS, TRACHEA AND BRONCHI

By N. ASHERSON

From the Ear, Nose and Throat Department, Queen Elizabeth Hospital for Children, London, and the Royal National Throat, Nose and Ear Hospital, London

DEATH follows rapidly when the glottis or the trachea becomes blocked by a swallowed bolus or foreign body (Fig. 1A, B and C). Such a tragedy occurs not infrequently and has been repeatedly recorded over the centuries.

Normal swallowing is controlled by a chain of co-ordinated complex reflexes. "All these events, because of their quickness, seem to occur simultaneously in the twinkling of an eye," as the immortal William Harvey wrote in *De Motu Cordis* in the seventeenth century (1628).

Disordered swallowing may divert the bolus into the air passages with the dire result depicted, which only prompt tracheotomy can avoid.

Death, delayed but inevitable, also follows if a main bronchus becomes blocked (Figs. 2 *et seq.*). Distressing persistent chest symptoms develop rapidly. The fatal outcome is avoidable if the intruder is promptly retrieved by a skilled endoscopist-laryngologist who has at his disposal suitable equipment.

Some relevant case records are given, illustrated with photographs and radiographs.

### IMPACTION IN THE GLOTTIS AND TRACHEA

Lucian, in his essay on octogenarians, relates that Sophocles the tragedian "swallowed a grape and choked to death at 91," while the columns of the daily newspapers, rather than those of the medical press, record regularly sudden death due to asphyxia, especially in an infant, from the inhalation of a swallowed foreign body—*e.g.*, an infant of 7 months sucking a crust of bread; another aged 9 months sucking an aniseed ball. Each of the following foreign bodies has also been the cause of asphyxiation: an orange pip (infant aged 9 months); nut from chocolate (infant aged 5 years); nut from cake (infant aged 15 months); a peanut (infant aged 15 months); a stud (in a 3-year-old child); toy balloon (child of 7). In another incident a child swallowed a wasp while drinking water. She was stung in the throat and died within a few minutes of suffocation from oedema.

Sudden death from an inhaled impacted foreign body is not confined to the beginning of life. *The Times* recently related how a man (aged 52) "collapsed while dining . . . and was dead on arrival at hospital. He had a large piece of undigested lobster flesh in his larynx" (*cf.* Fig. 1C showing a lump of meat wedged in the glottis).

Impaction results from a sudden deep full inspiration, there being no reserve of air in the lungs to expel the intruder. The deeper the inspiration the more firm the impaction, with the glottis firmly "corked." The treatment is immediate tracheotomy—if in time.

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Eastern fishermen who kill small fish by biting their necks have been asphyxiated by the live fish impacting in the glottis or trachea. Theocritus in the third century B.C. describes such an occurrence in the poem "The Fisherman."

*Aspiration of Vomitus: Asphyxia*

A man of 26 was chased by a policeman who punched him in the chest. He collapsed, had a convulsion and died. Food vomited up had lodged in his glottis and trachea, producing asphyxiation.

A man of 49 was driving a car, when he died suddenly owing to regurgitation of food from the stomach and impaction in the air passages. A case is recorded of a policeman aged 48 who fainted, vomited and died before arrival at hospital, the cause being impaction in the glottis of a piece of cheese which had been vomited up.

*Anæsthesia—Aspiration Asphyxia*

This accident is reflected in the case of a boy of 12 who sustained an injury at football. He was given a general anæsthetic to set a fracture, vomited and died, the vomited food impacting in his air passages.

Such an incident is becoming, alas! an all too frequent occurrence in these days of general anæsthesia associated with the general use of relaxants, especially when used in operations for acute intestinal obstruction.

The treatment is (1) *preventive* (emptying the stomach); (2) *precautionary*: avoid relaxants; use a cuffed endotracheal tube; or preserve the cough reflex; (3) *prompt powerful suction* with suitable suction ends to cope with any unexpected massive vomiting during induction.

*Post-operative Aspiration Asphyxia*

A post-nasal pack or sponge or even an over-looked large nasal or choanal polypus has caused the sudden death of the patient when it has lodged in the glottis or trachea while the patient was coming round from the anæsthetic after leaving the operating theatre. In a more recent incident an "absorbent" sponge left in a tonsil fossa to control bleeding was sucked into the air passage and produced an early post-operative fatal asphyxia. Were the condition recognised and suitable equipment ready and available in the resuscitation room, endoscopic removal would save such patient.

*Foreign bodies entering the Trachea (a) by Inhalation, (b) by Ulceration*

(a) Any large, solid foreign body, such as a pebble, date stone, or coin, can be inhaled through the narrowed glottis into the trachea, in a child or an adult, and remain loose there, bobbing up and down with coughing. It will not necessarily impact in a bronchus. Its maximum diameter may be greater than that of the normal glottis, so that it cannot be coughed out spontaneously or withdrawn bronchoscopically. On coughing the foreign body hits the tracheal surface of the approximated vocal cords, producing a click or a tracheal slap. X-ray screening will show the intruder to bob up and down.

The aspiration of a foreign body held in the mouth into the trachea results

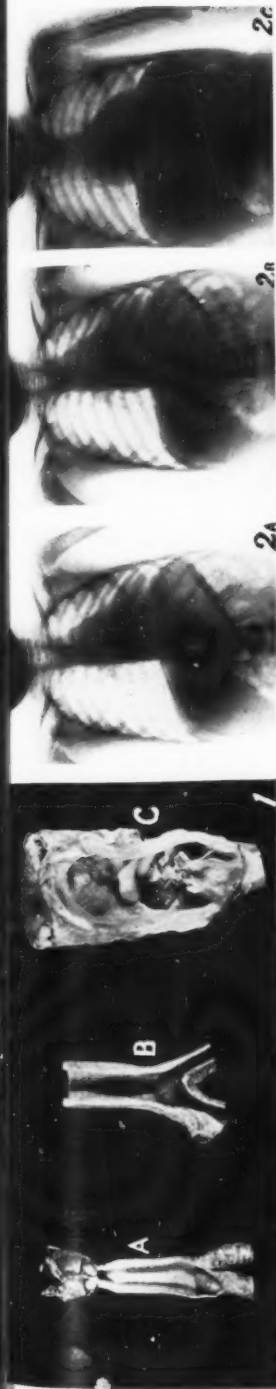


Fig. 1A.—Foreign body (bean) in trachea, producing asphyxia from obstruction.

Child 2½ years; death 2½ hours later; after impaction.

Fig. 1B.—Asphyxia from foreign body. Plum stone in trachea straddling the carina and obstructing both bronchi. Autopsy specimen (viewed from behind).

Adult aged 32. In an asylum 10 years; suddenly seized with dyspnea; cyanosis; died 6 hours later. Autopsy specimen. Both lungs partially collapsed at post-mortem. Diagnosis only made at autopsy.

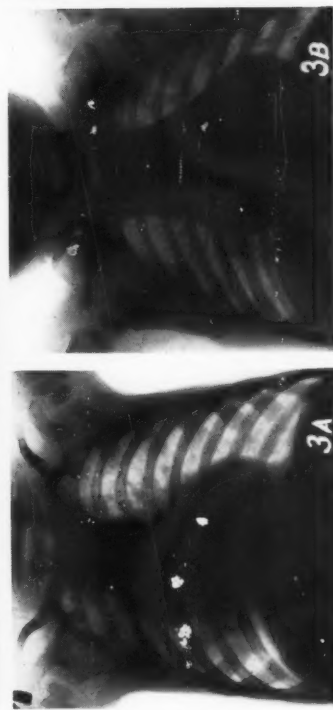


Fig. 3A.—Asphyxia from bolus of meat impacted in the glottis.

The specimens, numbered 2317.1, C.2316.1 and 2314.1, were in the museum of the Royal College of Surgeons in London. They were included in the collection of the Council for permission to reproduce them. They were destroyed by bombing during the war.

Figs. 2A and B.—Case 4 (1937). Peanut in left main bronchus producing obstructive atelectasis. Radiographs (A) at the end of inspiration and (B) at the end of expiration (details in text). Before bronchoscopy. September 4, 1937.

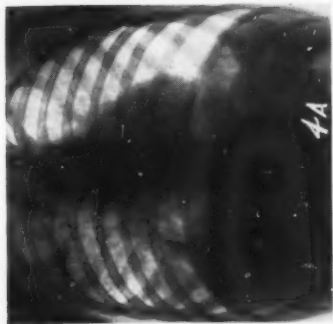


Fig. 2C.—After bronchoscopy: both lungs clear. Similar pictures were obtained on January 3, 1938, and September 19, 1938.

Fig. 3A.—Case 5. Before bronchoscopy: collapse of the right upper and middle lobes; the heart and mediastinum are drawn to the right; the diaphragm is raised.

Fig. 3B.—After bronchoscopy: lung fields clear.

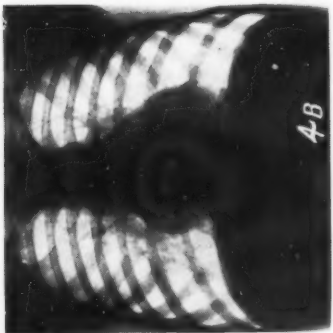
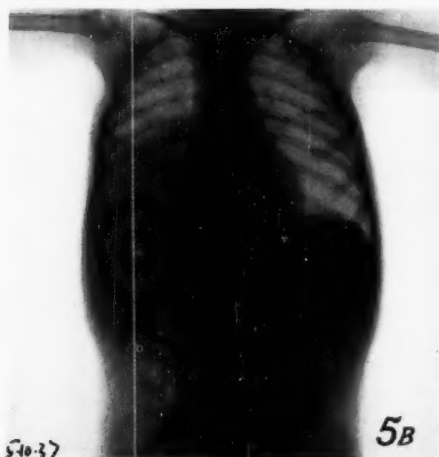


Fig. 4A.—C.K. Case 6. Peanut lodging in the right bronchus with collapse of the lung. The heart and mediastinum drawn over to the right. The percussion note was dull, with changing breath sounds. The right chest had diminished movement. Before bronchoscopy. March 27, 1938.

Fig. 4B.—After removal of the peanut by bronchoscopy. Both lungs are equally aerated; the heart has reverted to a normal position. April 27, 1938.

PLATE XXX



FIGS. 5A and B.—Case 7. *Known* peanut in right main lobe bronchus, producing collapse of the right lower and middle lobe. Pictures at end phase of inspiration and of expiration. Note shadow involving lower half of the right lung is constant in both phases; the heart and the trachea are pulled over to the right (same side that the diaphragm is raised at end phase of inspiration).

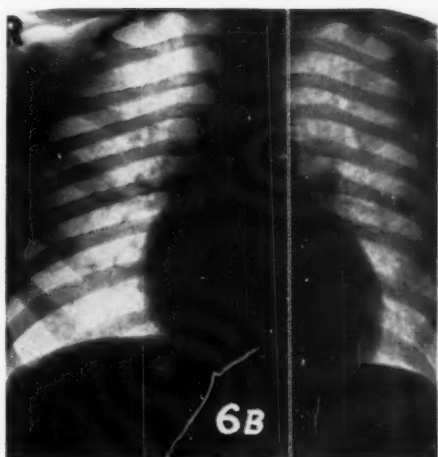
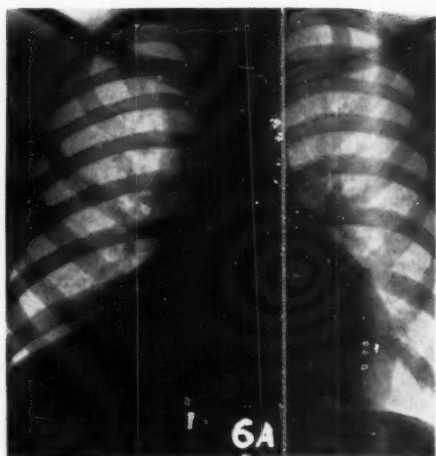


FIG. 6A.—Case 5. On admission, December 9, 1937, showing triangular shadows due to collapse of lower lobe of right lung. The same picture was obtained on February 26, 1938 (after Fig. 6B) before bronchoscopy.

FIG. 6B.—Case 5. January 6, 1938. The same picture was obtained on April 22, 1938, after bronchoscopy.

from the intense suction caused by a sudden, unexpected, uncontrollable violent inspiration, such as precedes a cough. The sudden onset and the intensity of such suction can be gathered from the following incident, which occurred during a tracheotomy operation. The anaesthesia was light. A demi-lune cartilage (the size of half a threepenny-bit) excised from the tracheal stoma and placed on the chest over 6 inches away was whisked into the depth of the lungs when the patient made a sudden, violent inspiration prior to coughing. It was promptly retrieved by suction through the stoma.

Removal of a large loose tracheal foreign body is best accomplished by prompt tracheotomy while maintaining the cough reflex under light anaesthesia.

The foreign body will be spontaneously coughed out through the tracheotomy stoma which is held open.

A stone or pebble (shaped like a date stone) and a closed safety-pin are the foreign bodies most liable to lodge loosely in the trachea (Figs. 2 and 3). Cherry, peach or plum stones (Fig. 1B) lodge in a main bronchus. Nails, needles and pins lodge in a peripheral bronchus.

A loose foreign body may enter the trachea by ulceration from without. A child, aged 12, seen in 1924 had persistent paroxysms of severe coughing which lasted about a week before she died. A loose, calcified tuberculous gland was lying freely in the trachea. There had been an audible thud on coughing, but its significance was overlooked.

#### CASE 1. *Closed safety-pin in the trachea of an infant*

(See BRIT. J. TUBER., 1951, 45, 138.)

This infant was observed to "swallow" the pin—which remained *in situ* without any cough, tracheal slap or thud in coughing or wheezing, though it was five days before the child attended and the pin was removed by bronchoscopy after detection by X-ray.

#### CASE 2 (1931). *Pebble loose in trachea*

A child aged  $4\frac{1}{2}$ , while playing with stones four weeks previously, commenced to cough violently. Another hospital (without an X-ray) reassured the mother that there was no foreign body in the lungs. Paroxysms of coughing, with occasional sputum, persisted.

An X-ray of the chest revealed a shadow near the bifurcation of the trachea which was at first assumed to be a gland, but on screening it bobbed up and down on coughing. It was a smooth, elongated ovoid pebble shaped like a date stone, and clicked against the beak of the bronchoscope when the child coughed. Removal by bronchoscopy was not possible. Tracheotomy was performed. The stone was coughed out through the stoma.

Unfortunately the child succumbed to broncho-pneumonia five days later (1931).

#### CASE 3

A soldier playing cards kept his money in his mouth, when a friend hailed him by slapping him on the back. A sixpence became lodged in his trachea. It was removed by bronchoscopy eighteen hours later.

## IMPACTION IN A MAIN AND/OR PERIPHERAL BRONCHUS

When a non-opaque foreign body (*e.g.*, peanut kernel) lodges in a main bronchus, and *obstructs* its lumen completely, the clinical signs are those of an atelectasis, with characteristic radiological changes, to determine which accurately the X-ray plates must be taken at the height of expiration and of inspiration (Fig. 2 A and B). If the obstruction is of a ball-valve type trapping more and more air with each inspiration, the signs are those of an obstructive emphysema. Where a lower lobe bronchus is obstructed a typical radiological picture is obtained (see Case 5, Fig. 6A).

*Radiological Findings*

## A. Of the normal lungs.

1. *During inspiration:*

- (a) Increasing translucency.
- (b) The dome of the diaphragm is depressed.
- (c) The intercostal spaces are widened.
- (d) The heart, mediastinum and trachea remain stationary in the mid-line.

2. *During expiration:*

- (a) There is decreased translucency.
- (b) The dome of the diaphragm rises.
- (c) The intercostal spaces narrow.

B. *In atelectasis* caused by obstruction of a main bronchus (usually the right) (Fig. 2A and B).

- (a) The heart and mediastinal shadows are drawn over to the obstructed lung.
- (b) The uniformly dark lung shadow remains unaltered throughout the respiratory cycle.
- (c) The diaphragm is persistently elevated.
- (d) The intercostal spaces are unaltered.

C. *In obstructive emphysema* the foreign body acts as a ball valve.

- (a) The heart and mediastinal shadows are pushed over to the opposite side.
- (b) On inspiration and expiration the affected lung remains hyper-translucent.
- (c) The cupola of the diaphragm is flat and depressed.
- (d) There is limitation of movement on that side.

There are the clinical signs of obstructive emphysema—*e.g.*, resonance, absence of breath sounds.

**Case Records**

## BRONCHIAL OCCLUSION BY NON-OPAQUE FOREIGN BODY

The following are case records of children with a non-opaque foreign body (usually a peanut) obstructing a main bronchus. Radiography invariably confirmed the diagnosis and a bronchogram was rarely necessary.



Preliminary screening and a direct antero-posterior very rapid exposure at the height of (a) inspiration and (b) expiration are necessary.

In "obstructive emphysema" the lung remains hyper-translucent at the end of expiration as the air is trapped.

#### *Main Bronchus Obstruction*

##### *CASE 4 (1937). Left main bronchus obstruction by peanut*

H. L., aged 5 years, admitted with dyspnoea, a hoarse voice and dry cough following the "swallowing" of a peanut kernel twenty-four hours before. The child was flushed, there was no cyanosis, temperature was  $101^{\circ}$ , respiration 32, there was diminished air entry of the left chest, especially at the base, with a pleural rub all over the left chest anteriorly.

Radiographs were those of a left-sided atelectasis (at the end of inspiration and expiration); they revealed a greatly diminished air entry of the left lung (see Fig. 2A and B)—i.e., unaltered aeration with the dome of the left diaphragm raised, even in full inspiration. The mediastinal shadow was displaced to the left, exposing on its right the right border of the vertebral column. It receded slightly to the right on expiration.

Bronchoscopy revealed a peanut kernel obstructing the left main bronchus. It was removed in fragments.

The picture is also consistent with a *right* "obstructive emphysema" due to an impaction in the *right* main bronchus with a ball-valve obstruction—i.e., the air can pass into but not out of the obstructed bronchus. The lung tissue becomes hyper-translucent at the end of both inspiration and expiration.

*Post-operative.*—Within three days the temperature and respirations were normal. There were rhonchi all over the chest with an equal air entry on each side. X-rays taken later showed the lungs filled equally with air, the diaphragm normal (Fig. 2c) and the heart in its normal position.

*Later Progress.*—The child remained well with only occasional bouts of coughing. A routine three-monthly examination of the chest was undertaken, and chest radiographs three months and twelve months later revealed no abnormality. On each visit a slightly diminished air entry was detected at the left base, with a sonorous expiratory squeak localised to a small area. Even while under observation for five days in hospital, the temperature remained normal and there was no coughing. Radiographs were negative. Sounds could still be heard at the left base.

Bronchoscopy was repeated twelve months later. A pool of pus filled the left bronchus and contained a fragment of peanut, which was removed.

Recovery was complete and persisted when the child was examined a year later.

##### *CASE 5 (1938). Right main bronchus obstruction by egg-shell*

T. S., 11 months old, five days previously was playing with a broken egg-shell. His breathing suddenly became distressed with a prolonged hacking cough for five minutes, which recurred an hour later. He became distressed at night with noisy respiration and was better during the day. Pneumonia and later asthma were diagnosed.

The respiration was noisy and distressed without cyanosis, temperature  $102^{\circ}$ , pulse 162, respirations 64. There was apparent laryngeal obstruction, with recession of the intercostal spaces on inspiration and excessive abdominal breathing. The entire right side of the chest was dull to percussion with diminished air entry at the base, suggesting massive collapse of the lung.

X-rays (Fig. 3A) showed collapse of the right upper and middle lobes, with the heart and mediastinum drawn over to the right and the diaphragm raised.

Bronchoscopy revealed pus welling up through the glottis from the trachea and an acute congestion in the trachea and bronchus, especially the right main bronchus. This contained pus which was aspirated; the lumen was clear and contained no foreign body. Immediately afterwards the breathing became equal on both sides. A relapse occurred soon after with respiratory embarrassment till the next day. Improvement followed vomiting. Temperature 103° pulse 92, respirations 40. Four days later, temperature 99, respirations 30. Five days later the child was convalescent; X-ray showed equal air entry (Fig. 3B).

**CASE 6 (1938). *Right main bronchus obstructed***

C. K., aged 7, was eating peanuts; one "went down the wrong way." For a week there was a great deal of coughing and the general condition was deteriorating with slight cyanosis and dyspnoea. The temperature was 101·8°, the pulse 130, respirations 60. The right side of the chest moved poorly, with a dull percussion note and diminished breath sounds with crepitations at the base. There was no displacement of the heart. X-ray (Fig. 4A) shows the right lung opaque with the heart and mediastinum drawn over to this side.

The peanut was removed by bronchoscopy (Fig. 4B). Recovery was complete.

**CASE 7. *Right main bronchus block***

1937, infant aged 5 years had a history of continuous coughing following the swallowing of a peanut a few days previously. The child was ill, with persistent coughing, respiratory distress, with signs of obstruction and collapse of the right lung (Fig. 5A and B).

Bronchoscopy revealed a diffuse purulent tracheo-bronchitis. The symptoms and physical signs remained unchanged. Some days later a second bronchoscopy was performed, but again the foreign body eluded detection. The child remained ill with a high swinging temperature and then developed laryngeal diphtheria. In spite of tracheotomy, the child succumbed. At autopsy a peanut was found in an abscess cavity in the right lower lobe.

**CASE 8 (1937). *Right lower lobe bronchus obstruction***

G. C., aged 6½ years, had a cough for three weeks which had become worse in the last four days. The temperature was 101·6°, pulse 136, respirations normal. Breath sounds were faint and there was an impaired percussion note at the right base.

An X-ray (Fig. 6A) showed the typical triangular shadow produced by collapse of the lower lobe of the right lung. The right diaphragm was raised on screening. Mantoux test was negative. The temperature settled in five days; there was no cough.

An X-ray one week later (Fig. 6B) showed the chest clear without any abnormal physical signs.

He was readmitted six weeks later, having become febrile a week previously, with a severe cough and sputum. The right lobe showed diminished movement, poor breath sounds and impaired percussion note. An X-ray (Fig. 6A), again showed collapse of right lower lobe, attributed to enlarged mediastinal glands, or to intrabronchial obstruction, which confirmed a bronchogram. The Mantoux test was negative.

Bronchoscopy revealed a peanut kernel, unchanged by its prolonged sojourn. It was removed intact. Recovery was complete. This was checked one month later by X-ray.

#### Comment

The variations in the clinical and the X-ray findings indicate that repeated examinations are necessary for a diagnosis. There was no history of an inhaled foreign body.

## BRONCHOGRAPHY USING TWO NEW MEDIA

BY N. McSWAN AND G. W. ALLAN

From the Thoracic Unit, Ruchill Hospital, Glasgow

IODISED poppy-seed oil has been universally utilised as an opaque medium for bronchography for many years. The usual preparations contain 40 per cent. free iodine and give a sharply defined outline of the bronchial tree. The main disadvantage of such substances is the obscuring of subsequent X-ray films for several weeks or months and, in the event of alveolar filling, sometimes for years. This may cause difficulty in interpreting radiographs of patients suffering from pulmonary tuberculosis and has led to a search for other media which will show rapid radiological clearing.

We present our experience with two such new products, Dionosil (Glaxo) and Oily Dionosil (Glaxo).

Dionosil is a 50 per cent. w/v aqueous suspension of the *n*-propyl ester of 3:5 diiodo-4-pyridone-N-acetic acid with the addition of sodium carboxymethyl cellulose. It has an iodine content of 30 per cent.

Oily Dionosil is a 50 per cent. suspension of the same *n*-propyl ester in arachis oil.

We have compared these new media with iodised oil as administered by the over-the-tongue technique. This is our normal method of bronchography and is now briefly described.

No premedication is given, but sodium thiopentone is immediately available. This allows bronchography to be carried out on out-patients without provision of beds or nursing staff.

The procedure is explained to the patient. In particular it is pointed out that both the local anaesthetic and the medium are to trickle over the tongue and be inhaled. When the local anaesthetic is first trickled over the tongue, coughing is induced, but this subsides as anaesthesia is established. At first  $\frac{1}{2}$  per cent. solution of amethocaine hydrochloride is used. After about 2 ml. has been given the patient has accustomed himself to the technique and a 1 per cent. solution is substituted. The total quantity used is equivalent to 6 ml. of the 1 per cent. solution.

The patient is tilted slightly to one side and the medium administered by the same method, taking from one to two minutes to introduce the 12 ml. of iodised oil required for one lung.

By this time the basal segments are filled, so the patient is tilted head down in the lateral position, and by slightly turning his chest the anterior, apical and posterior branches of the upper lobe are filled, allowing five seconds for each. The middle lobe or lingula is next filled by placing the patient in the prone position for five seconds, then the apical branch of the lower lobe by allowing him to lie flat on his back for five seconds. The patient is then X-rayed in the views required.

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Lastly, he is given instructions on postural drainage and told not to eat or drink for two hours.

The advantages of this technique are the ease and speed with which bronchography can be carried out, and the fact that the inconvenience and discomfort of intubation or injection are avoided. The whole procedure takes ten minutes in the average case.

The results, using the over-the-tongue technique, vary from one thoracic unit to another. The use of fluoroscopy while the oil is being introduced brings out the important points in technique. It is seen that the medium reaches the carina quickly and flows mainly into the lower lobe. On tilting the patient laterally, the upper lobe is seen to fill extremely quickly with oil which flows from the lower lobe but leaves the lower lobe bronchi outlined. The speed with which iodised oil flows along the bronchial tree underlines the necessity for avoiding delay between the introduction of the oil and the process of tilting, and between the tilting and the taking of X-ray films. When these points are given due attention, overfilling seldom occurs and the entire bronchial tree is well outlined.

Of 100 consecutive bronchograms performed by this method, we graded 85 excellent and 10 adequate. The term "excellent" implies that all the branches of the bronchial tree were satisfactorily outlined, and the term "adequate" implies that that part of the bronchial tree on which interest was centred was completely outlined, but that branches in another area were not fully demonstrated.

#### DIONOSIL

Eighteen patients had bronchograms performed with this medium. When we first introduced Dionosil by the same method as that used for iodised oil, marked coughing resulted, as might have been expected from a watery preparation. Premedication in a few cases with omnopon gr. 1/3 or Nembutal gr. 3 did not allay this irritation, but by using 8 ml. of 1 per cent. local anæsthetic agent and waiting for fifteen minutes before introducing the medium, better results were obtained.

The first few bronchograms showed filling of the lower lobes only, and even with prolonged tilting filling of the upper lobe could not be obtained. A larger volume of Dionosil was used—up to 30 ml.—with no better result. Fluoroscopy now showed that once Dionosil had reached the lower lobe it appeared "fixed" and would not flow on subsequent tilting. For a satisfactory bronchogram it was found advisable to fill the upper lobe first, with the patient lying on his side, using 8 ml. of Dionosil, and then using a further 12 ml. to outline the lower and middle lobes with the patient sitting up.

The earlier bronchograms had also shown that the Dionosil did not penetrate along the smaller bronchi as far as iodised oil. Fluoroscopy showed that controlled coughing spreads Dionosil distally, yet does not produce alveolar filling.

With this revised technique it was possible to obtain satisfactory bronchograms using 20 ml., but the procedure involved more time and trouble than with iodised oil. Using the same criteria as for iodised oil, in eighteen cases the bronchograms of seven were assessed as excellent, eight as adequate and three as unsatisfactory.

The contrast obtained by Dionosil was good, although definition was not so sharp as with iodised oil, owing to the lower iodine content. Alveolar filling was less, as Dionosil does not penetrate the finer twigs of the bronchial tree to the same extent as iodised oil.

Radiography forty-eight hours later showed complete clearing of the lung fields in all cases. No toxic reactions were noted; there were no cases of iodism.

#### OILY DIONOSIL

Fifty patients had bronchograms performed with this medium.

After local anæsthesia, using 6 ml. of 1 per cent. amethocaine hydrochloride or equivalent, Oily Dionosil could be immediately introduced over the tongue without producing coughing, and the total quantity could be given as quickly as iodised oil.

Fluoroscopy showed that on tilting the patient this new medium flowed readily from one lobe to another. There was not the same tendency to "fix" that was noted with Dionosil. In fact, in a small number of cases the upper lobe was seen on screening to be completely outlined, but after one minute some of the medium had already flowed out of the upper lobe, leaving incomplete filling. This effect also accounted for the difference of filling in postero-anterior and lateral radiographs when there was any undue delay between taking these two X-rays.

Where delay in tilting the patient and taking X-rays was avoided, the results with Oily Dionosil were very satisfactory (Figs. 1, 2, 3, 4). Eighteen ml. were used for each lung and administration was easy. Using the same criteria as before, in fifty cases the bronchograms of forty-four were assessed excellent, four adequate and two unsatisfactory.

The contrast obtained was similar to Dionosil and adequate, but the bronchial tree was outlined to a greater extent than was possible with the aqueous preparation, because the oily medium penetrated more distally.

Alveolar filling occurred not infrequently, but radiography forty-eight hours later showed complete clearing of the lung fields in all cases.

Toxic reactions were noted in three out of fifty cases. All showed a raised temperature. In the first case it rose to 101.6° F. five hours after bronchography without any other signs or symptoms. Twelve hours later it had returned to normal. In the second case the temperature was raised to 100.2° F. after five hours, returning to normal in twelve hours, again without symptoms. The third patient complained of pain over the right lung base, aggravated by inspiration, five and a half hours after a right bronchogram. This was accompanied by a temperature of 99.6° F. which returned to normal in forty-eight hours.

#### Discussion

We have compared the media under four main headings:

Ease of administration.

Clearing of lung fields as shown by radiography.



## Toxic reactions.

## Quality of bronchogram.

*Ease of Administration.*—Iodised oil and Oily Dionosil are particularly suitable for the over-the-tongue technique. A satisfactory bronchogram takes ten minutes to accomplish from start to finish. Dionosil, the aqueous preparation, is more difficult to administer by this method. Cough is difficult to suppress, and this sometimes results in a considerable quantity of Dionosil being coughed up from the trachea before it can outline the bronchial tree. Modifications of the technique were required, necessitating more anaesthetic, more complicated posturing and the introduction of the medium in two stages and at a slower rate. The time taken was much longer and averaged twenty-five minutes.

*Clearing of Lung Fields.*—Overfilling with iodised oil causes persistent mottling in subsequent films for several weeks or months, and in patients suffering from pulmonary tuberculosis the disadvantage is obvious.

Using Dionosil or Oily Dionosil, the lung fields are radiologically clear of medium in forty-eight hours. In one case not included in this series, where bronchography was carried out by intubation using a Métras catheter, a segment was considerably overfilled, but even in this case clearing was substantially complete in three days.

These rapidly excreted new products permit bronchography to be carried out in cases of pulmonary tuberculosis without incurring the risk of obscuring subsequent films.

*Toxic Reactions.*—With iodised oil the iodine is absorbed as free iodine and a small number of cases exhibit symptoms of iodism following its use. If the oil is swallowed iodism is more likely (Theodos, 1952).

With Dionosil and Oily Dionosil, the iodine is absorbed in a combined form and theoretically iodism should not occur; it did not arise in the sixty-eight cases presented.

A transient febrile reaction has been noted as a side effect of Dionosil in twelve cases out of forty-five by Don (1952), but no such reaction occurred in our cases. Similar "flu"-like effects were reported using a watery soluble contrast medium "Umbradil" by Salzman *et al.* (1952). Minor pyrexial incidents were noted in three of our cases where Oily Dionosil was the medium employed. The cause may lie in the stirring up of latent infection of a minor nature.

*Quality of Bronchograms.*—Iodised poppy-seed oil gave a sharply defined and complete outline of the bronchial tree and a satisfactory result in 95 per cent. of cases.

Dionosil did not give such a complete outline of the bronchial tree; the larger branches filled well but the finer ones did not. The definition was not so sharp, owing to the lower iodine content, but was adequate. The percentage of satisfactory bronchograms using the over-the-tongue technique was smaller, and it is doubtful if the advantage of clearing outweighs these drawbacks. It may be that other techniques will prove more suitable for this medium.

Oily Dionosil gave as complete a picture as iodised oil. The contrast



was less, again because of the lower iodine content, but was quite adequate for all practical purposes. Alveolar filling can occur with Oily Dionosil if care is not taken to avoid it, but the consequences are not as serious as with iodised oil because of its rapid excretion.

It may be indeed that in certain conditions studies of bronchograms in which early alveolar filling has taken place will prove of value.

### Summary

Bronchography using the over-the-tongue technique was carried out in eighteen cases with Dionosil, an aqueous contrast medium. The results were not considered wholly satisfactory. Oily Dionosil, an oily suspension of the same basic substance, was used in fifty cases with consistently good results. Contrast was satisfactory, although not quite as sharp as with iodised oil.

With both preparations clearing of the lung fields occurred within forty-eight hours.

Our thanks are due to Dr. A. W. Lees for constant advice; to Dr. W. O. Thomson for assistance; to Mr. J. McKurdie for the photographs; to the Radiology Staff for co-operation; and to Glaxo Laboratories, Ltd., for a supply of the Dionosil preparations.

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PLATE XXXI

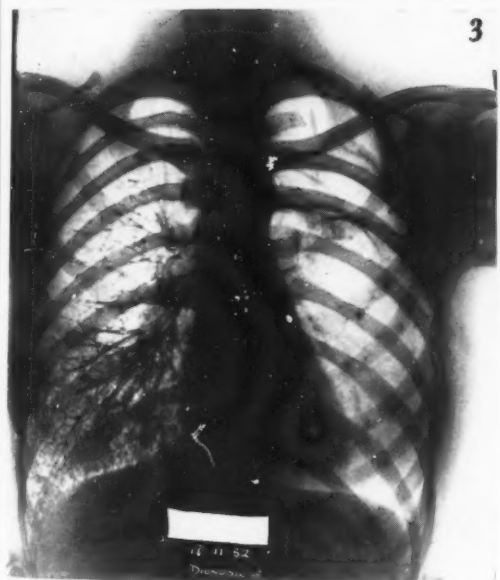
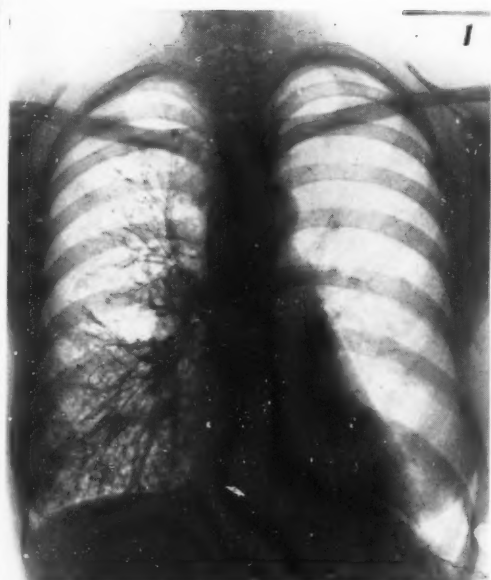


FIG. 1.—Postero-anterior view of right bronchogram using oily dionosil.

FIG. 3.—Postero-anterior view of normal right bronchogram using oily dionosil. A left extrapleural pneumothorax is present.

FIG. 2.—Unusual anatomical distribution of the segmental branches of the upper lobe shown by right lateral view of same bronchogram.

FIG. 4.—Right lateral view of same bronchogram showing alveolar filling of right middle lobe.

PLATE XXXII

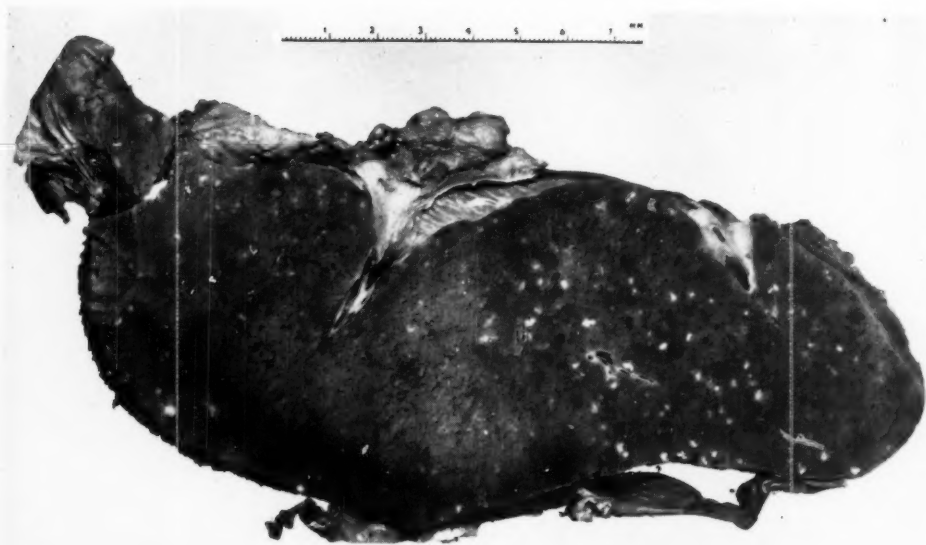


FIG. 1.—Spleen, showing scattered caseous nodules.

## TUBERCULOUS PORTAL PYÆMIA WITH SPLENOMEGALY

BY P. O. LEGGAT, G. PENRHYN JONES AND P. J. TAYLOR

From Aintree Hospital, Liverpool

TUBERCULOUS portal pyæmia with splenomegaly is a rare condition described in the literature under various names—acute tuberculous septicæmia with leucopenia (Ball *et al.*, 1951), and atypical abdominal tuberculosis with hæmatological manifestations (Friend *et al.*, 1952). So far fifteen well-authenticated cases have been described, although, with the exception of one in which the spleen was removed for chronic thrombocytopenia (Friend, 1952), all the others were diagnosed at necropsy.

The following case is thought to be of interest, as the correct diagnosis was reached some considerable time prior to the patient's death, which occurred in spite of adequate therapy.

### Case Report

The patient, a male aged 37, was originally found to have bilateral chronic pulmonary tuberculosis whilst serving in the Navy in 1945. Following his medical discharge the disease was assessed as quiescent and he became a teacher. In June 1951 he developed a considerable blood-stained effusion on the right side of the chest from which was cultured *M. tuberculosis*. The spleen was enlarged 2 inches below the costal margin and firm to palpation. Scattered purpuric spots were seen over the trunk. The blood picture at this time (18.9.51) revealed a slight degree of anæmia with considerable neutropenia and thrombocytopenia (see table).

Dr. M. C. G. Israël examined smears made from aspirated sternal marrow on three separate occasions and reported that they showed intense erythroblastic hyperplasia.

At this stage the patient showed no evidence of fever or tachycardia. He was treated with bed-rest and oral iron therapy. The fluid in the chest gradually absorbed and the blood picture improved slightly until November 1951, when maximum improvement was obtained, but still with considerable neutropenia.

The diagnosis was thought to be that of abdominal tuberculosis with secondary hypersplenism. Clinically he remained fairly well until May 1952, when there appeared a cough, high intermittent fever and rapid swelling of the abdomen. Paracentesis yielded greenish-yellow fluid containing 7 G. per cent. of protein and numerous lymphocytes. Guinea-pig inoculation of a specimen of this fluid was positive for tuberculosis. The serum proteins and liver function tests were normal.

Treatment was started with dihydrostreptomycin 1 G. daily and P.A.S. 18 G. daily and was continued for twelve weeks. Within two months of starting chemotherapy his general condition was much improved, temperature had

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settled and the ascites had absorbed. The blood picture, however, was deteriorating and his sputum now contained *M. tuberculosis*.

From September 1952 he became progressively worse with a high continued fever and persistent headaches. The spleen increased in size, the liver became enlarged and firm, and in spite of adequate blood transfusions and hæmatinics he died six weeks later. The blood picture shortly before death is shown in the accompanying table. Marrow aspirated from an iliac crest was extremely hypoplastic; the sternal tap was "dry."

#### NECROPSY

Emaciation was severe. The right lung was bound by dense pleural adhesions and had nodular disease in the upper lobe with calcification and fibrosis. Œdema and bronchopneumonia characterised the lower lobe. On the left side there was a large blood-stained pleural effusion, with nodular fibrotic and partly calcified lesions in the upper lobe. There were small scattered calcified foci in the lower lobe.

One tubercle, 5 mm. across, was found on the lesser curvature of the stomach.

The liver (2,350 G.) was studded with minute tubercles. Large caseous glands presented at the porta hepatis and a chain of them stretched along the splenic vein across to the spleen. The spleen (1,000 G.) was enlarged to just below the costal margin. It contained a large number of tubercles up to 1.5 cm. in diameter. The splenic pulp was soft and diffuent, with prominent Malpighian corpuscles (Fig. 1).

A few calcified glands were found in the ileo-cæcal area. Marrow from many sites appeared red and mushy and both femoral shafts were filled with it. Swabs taken from the spleen and lymph nodes all showed numbers of *M. tuberculosis* on direct examination. Microscopic examination of the spleen, liver and lymph nodes confirmed the presence of caseous tuberculous lesions. Sections of the sternum and femur showed a normal marrow stroma, but few hæmopoietic cells, and these mainly of a primitive type.

#### Discussion

It is interesting that this unusual form of tuberculosis appears to occur most frequently in the fourth decade or after and to be more common in males.

From a review of cases described in the literature, they would appear to fall into three groups:

- (1) Cases associated with a fresh primary lesion.
- (2) Cases with evidence of active adult reinfection pulmonary tuberculosis.
- (3) Cases with no evidence to suggest either of these conditions.

Two cases (Nasse, 1931; Von Wyss, 1940) can be allocated to the second group. There are five cases where the primary has been obvious or the pathological findings have been suggestive of this condition (Scholz, 1918; Siegmund, 1939; Ball *et al.*, 1952). The remaining cases, belonging to Group 3, have been recorded by a variety of authors—Müller, 1938; Steinbrinck, 1938; Von Wyss, 1940; Kernohan, 1951; Friend *et al.*, 1952. Our own particular case belongs to Group 2.

It is interesting to speculate on the pathogenesis of this condition. Whether

the original primary tuberculous infection occurs early or late, the post-primary hæmatogenous dissemination is well known. From a study of the cases recorded it is obvious that this is the mechanism in some cases where the tuberculous lesions have been found in the spleen and liver. In those examples—and they are in the majority—where no active primary lesion is discovered, some other explanation must be sought. Although tuberculous meningitis is usually associated with the first decade of life, it is not unknown in cases of adult reinfection tuberculosis, and even on occasions generalised miliary tuberculosis occurs. Gross splenic enlargement, however, is not a feature.

In a primary infection, caseous metastatic foci of considerable size may develop in the liver and spleen. In spite of their size they frequently heal and in later years they are seen as multiple calcified nodules (Shands, 1933; Moorman, 1937; Solomon and Doran, 1939; Konstam, 1949; Astley and Harrison, 1949).

Should one or more of these foci fail to heal completely, it is conceivable that at a time when the general resistance of the body is lowered the lesion may reactivate and disseminate itself via the portal system. This would explain the characteristics of the case reported in this paper, where the abdominal lesions were confined to the liver, spleen, and the lymph nodes draining them, with a solitary focus in the stomach. The well-calcified glands in the mesentery appeared to be evidence of an old primary infection, now soundly healed locally. This would explain the absence of meningeal signs and miliary changes in the lungs and elsewhere. It is difficult to understand why, with these lymph nodes involved, generalised infection did not occur via the thoracic duct. A tuberculous infection of the cervical lymph nodes localises in a similar fashion.

The ascites may be explained by postulating a rupture of one of these lymph nodes with dissemination of tubercle bacilli. Tuberculous portal pyæmia seems to us to be a reasonable description for this disease process, mainly confined as it was to the portal system.

In the cases previously described, the spleen is noted as palpable in nine, but no weights are given. In the majority the blood picture is predominantly leucopenic with the granulocyte series mainly affected (Scholz, 1918; Nasse, 1931; Steinbrinck, 1938; Siegmund, 1939; Von Wyss, 1940). In two cases there was a neutrophil leucocytosis (Friend *et al.*, 1952).

Three possible mechanisms are suggested from this blood picture:

- (1) Hypersplenism (Englebreth-Holm, 1938).
- (2) Tuberculous foci in bone marrow (Gourley *et al.*, 1949).
- (3) Tuberculous septicæmia (Ball *et al.*, 1951).

In the case cited here, the patient's spleen was enlarged and there was no evidence to suggest a generalised infection. Initially there was extreme hyperplasia of the bone marrow, and this is compatible with hypersplenism. Wiseman and Doan (1939, 1942) emphasise the following features in this latter condition: profound granulocytopenia, hyperplasia of the bone marrow, splenomegaly, and the curative effect of splenectomy.

Hickling (1938) reported a case in which miliary lung lesions resolved following splenectomy, and Englebreth-Holm (1938) goes as far as to assert that splenectomy may be an essential life-saving procedure.

The question of splenectomy was frequently discussed in relation to this patient, but his general condition was so poor that it precluded surgical interference.

Chronic neutropenia appears to have had an important bearing on this patient's failure to gain control over his disease, as an early defence mechanism in tuberculosis is the development of a polymorphonuclear exudate (Pinner, 1947).

### Summary

A case of tuberculous portal pyæmia is described and the literature on this subject reviewed. The pathogenesis of this condition and the blood changes are discussed.

We are indebted to Dr. O. F. Thomas for permission to publish this case, to Dr. F. Whitwell and Dr. M. C. G. Israëls for their valuable help, and to Mr. J. Wall for the photograph.

### BLOOD COUNTS

	18.9.51	14.11.51	14.5.52	17.10.52
Hb. % Haldane .. ..	80	89	48	36
R.B.C. mill/cu. mm. ..	4.2	4.6	2.57	2.0
W.B.C. cu. mm. .. ..	1,700	3,300	600	600
N.P. % .. ..	57	30	80	40
B.P. % .. ..	—	—	—	2
Lymphs % .. ..	42	67	20	51
Mons % .. ..	1	3	—	7
Platelets /cu. mm. .. ..	90,000	100,000	40,000	95,000

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PLATE XXXIII

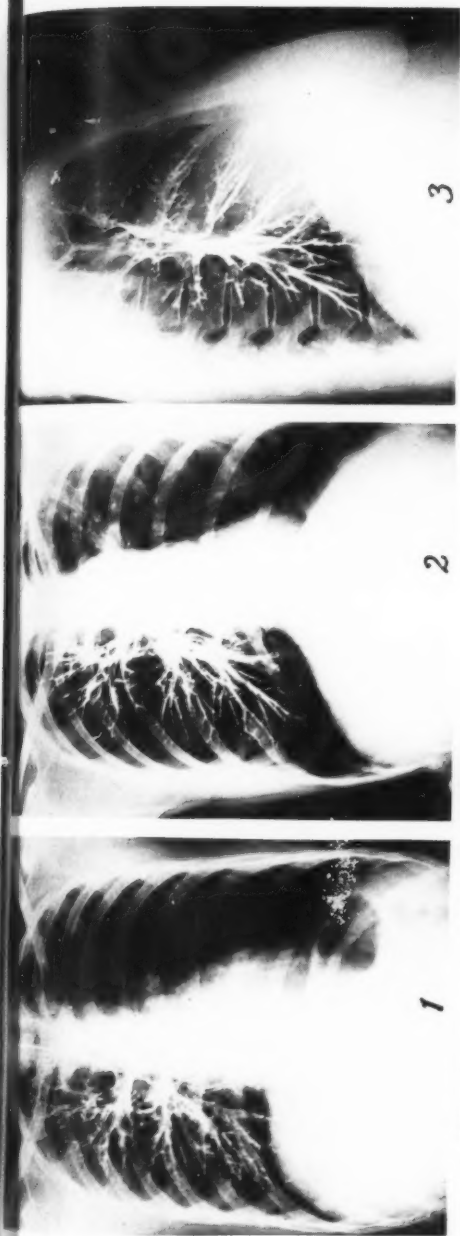


FIG. 1.—Normal right bronchogram.

FIG. 2.—Right bronchogram in case of asthma with fibrotic tuberculous disease of left lung.

FIG. 3.—Normal right lateral bronchogram.

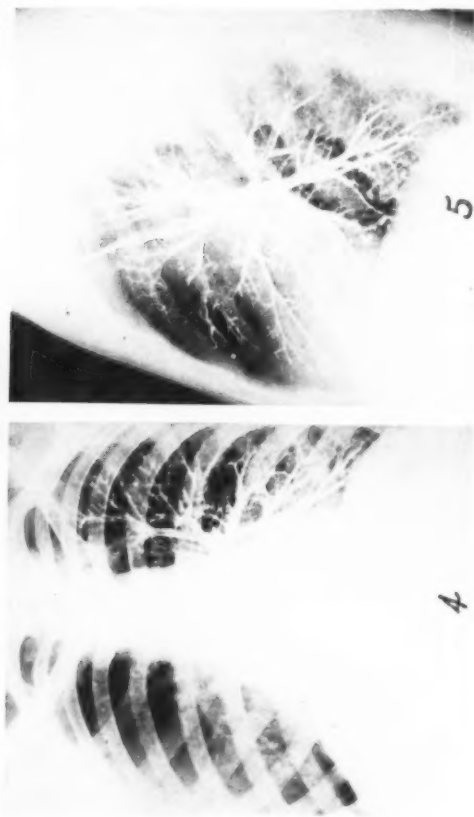


FIG. 4.—Normal left bronchogram.

FIG. 5.—Left lateral bronchogram. Minimal bronchiectasis of anterior basal segment.

# PLATE XXXIV

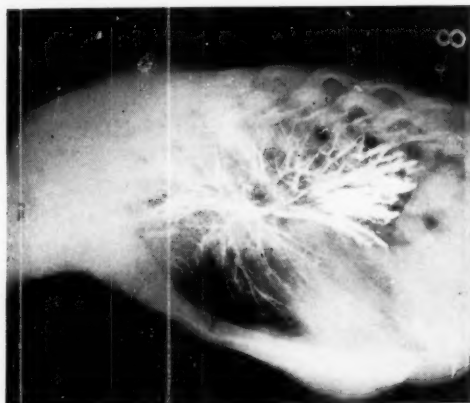


Fig. 6.—Left posterior-oblique bronchogram, demonstrating bronchiectasis of basal segments of left lower lobe.

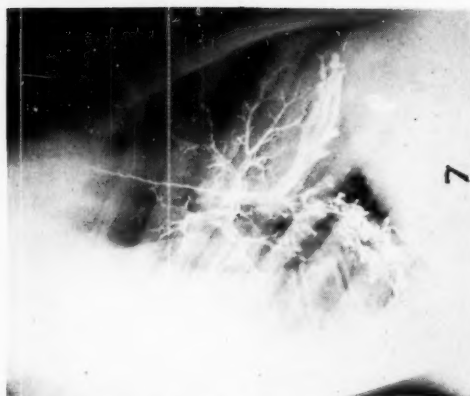


Fig. 7.—Right lateral bronchogram, demonstrating bronchiectasis of right lower and middle lobes with compensatory expansion of upper lobe segments.



Fig. 8.—Left lateral bronchogram showing bronchiectasis of basal segments of left lower lobe.

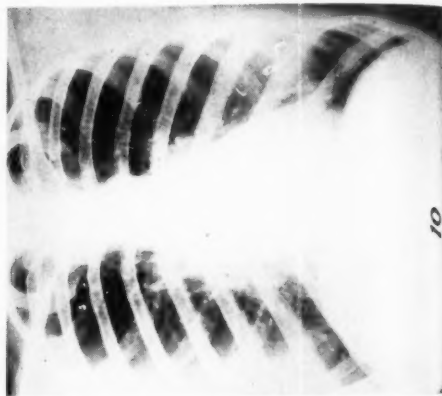


Fig. 9.—Normal right bronchogram.

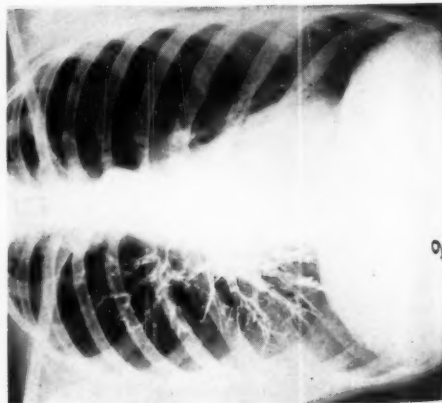


Fig. 10.—Same case showing clearing of lipiodol following 1 hour's postural drainage.

## BRONCHOGRAPHY: A PLEA FOR THE USE OF SUSPENSION OF SULPHANILAMIDE IN IODISED OIL

BY P. L. SALINGER AND H. G. H. HOUGHTON

From King George V Hospital, Durban, South Africa

WE should like in this paper to stress again the value of using thickened iodised oil for bronchography. The method first used by Dormer at King George V Hospital, Durban, was described in 1945 (Dormer, Friedlander and Wiles), 1947 (Dormer and Wiles), and again in 1951 (Houghton and Ramsay).

The advantages of being able to perform good bronchograms safely on cases of pulmonary tuberculosis who might benefit by surgery must now be obvious. Fear of possible complications associated with alveolar filling, so frequently seen when a thin opaque medium is used, has been responsible for depriving patients of a valuable means of assessment.

If used intelligently the suspension is safe; it is not associated with reactions; it is not followed by spreads, and does not interfere with subsequent X-ray interpretation. There is more control in directing the medium into any part of the lung. Segmental bronchi are outlined rather than filled, and by correct posturing the lung can be emptied almost completely within a few hours.

Furthermore, in cases of bronchiectasis or abscess the presence of sulphanilamide is of therapeutic value.

Since 1942 over 7,000 bronchograms have been performed in this centre by this method. Various combinations of sulphonamide in iodised oil have been tried. In our climate we prefer to use 6 or 7 G. sulphanilamide to 20 c.c. lipiodol Lafay 40 per cent. The technique of instillation under local anaesthetic has been described in our previous publications. We try to avoid filling more than one lung at one sitting and think that the supraglottic method is the most simple and least unpleasant for the patient. No injections or needling of any description are required.

We have used the water-soluble agents but in our experience they are irritating and require more local anaesthetic. During the past two years the only spread seen by us following a bronchogram was in a case where a water-soluble agent was used.

The reproductions illustrate the quality of the bronchograms obtained in normal and diseased lungs. In all cases subsequent films were in no way obscured by residual lipiodol and there were no ill effects. Figures 9 and 10 demonstrate that the suspension can be removed from a lung within one hour.

Being convinced of the advantages of the thickened suspension over all other known opaque media, we feel that it should be more widely used or at least given a fair trial.

(Received for publication June 23, 1953.)

We wish to thank Miss McLaggan for the reproductions, and the various members of the staff of King George V and Wentworth Hospitals for the bronchograms contributed.

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FINGER CLUBBING AND CHANGES IN THE  
BRONCHIAL CIRCULATION

BY LEON CUDKOWICZ AND JOHN B. ARMSTRONG\*

Formerly from the Department of Medicine, Postgraduate School of Medicine,  
London

THE association of finger clubbing and intrathoracic disease has been recognised since ancient times, but their causal relationship remains unknown. Mendlowitz (1942) listed bronchiectasis, lung abscess, empyema, protracted pulmonary tuberculosis, pneumoconiosis, atelectasis, primary bronchial, pulmonary and mediastinal neoplasms, "pulmonary hæmangioma," cyanotic congenital heart disease, non-cyanotic congenital heart disease complicated by subacute bacterial endocarditis, and bronchiectasis complicating mitral stenosis, as the more common chest disabilities in which clubbing is seen. He reviewed a number of theories calculated to explain clubbing in chest disease but found them as a whole unconvincing. In a previous study, Mendlowitz (1938) observed that finger clubbing in lung and heart disease was accompanied by an increased blood flow to the fingers and a decrease in the pressure gradient in the brachial digital arterial tree. In 1941 Mendlowitz published an interesting account of an experimental attempt at the production of clubbing in a dog. By anastomosing a pulmonary artery to the left auricle, changes suggestive of pulmonary osteoarthropathy were seen. The main effect of this procedure was an increase of cardiac output and a reduction of the oxygen saturation in the systemic arteries. Barnes, Fatti and Pryce (1948) and Baker and Trounce (1949) discussed changes in the pulmonary circulation in relation to pulmonary arterio-venous aneurysms. They thought a rapid passage of blood from the pulmonary arterial to the pulmonary venous circulation was of importance in the mechanism of clubbing.

A study of the local abnormalities in clubbed fingers was reported by Lovell (1950), who recognised an excess of fibrous tissue in the distal segments, particularly between the nail bed and the phalanx, and an increase in the calibre of the digital arteries. Characteristic local arterio-venous anastomoses were seen in abundance in the distal finger segments near the junction of the dermis and the subcutaneous tissues. The efferent vessels from the anastomoses opened into deep venous plexuses in the distal part of the fingers. He thought that the excess of blood reaching the finger tip was largely directed through these anastomoses, and the by-pass of blood directly into the venous plexuses away from the capillary bed might be responsible for the proliferative changes seen in the terminal segments of clubbed fingers. In a recent study by Wilson (1952) on local heat elimination from clubbed fingers under conditions of full vasodilatation and after anæsthetising the ulnar nerve at the elbow, it was shown that blood flow through clubbed fingers was greater than in the normal.

\* Now at the University of Manitoba, Canada.

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The blood flow could not be further increased by eliminating nervous factors once full vasodilatation had taken place. It was thought improbable that vasomotor nerves were responsible for the increased peripheral blood flow in clubbing.

Other causes, particularly vascular abnormalities, may be of more direct importance in the increased peripheral circulation, which Wilson regards as "a consistent and essential feature in acquired clubbing." Cross and Wilson (1950) recorded a case of an axillary arterio-venous aneurysm with unilateral clubbing, where the only circulatory abnormality demonstrable was a greater blood flow to the hand distal to the aneurysm.

The possibility that pulmonary vascular abnormalities might be present in those heart and lung diseases in which clubbing was a conspicuous feature prompted us to examine the bronchial circulation at post-mortem in a variety of these diseases. It is proposed to describe the changes which were consistently seen in the bronchial circulation and to discuss their relation to clubbing.

#### METHOD

The study was carried out soon after death by means of a radio-opaque injection medium, too coarse to penetrate vessels of less than  $60\mu$  in diameter, which was injected into the bronchial arteries. By this method, which has been described in detail (Cudkowiec and Armstrong, 1951), it was possible to obtain radiograms of the thoracic contents prior to the histological studies of the pulmonary and bronchial circulations. The fixing properties of the medium employed made possible detailed microscopical examination of the injected vessels in sections of the lungs. The radiographic patterns, seen before the lungs were fixed, facilitated careful planning of the cutting of such blocks as were most likely to yield instructive information.

#### MATERIAL

The lungs of fifteen subjects were examined. The degree of clubbing present allows the division into four groups.

*Group 1* with first-degree finger clubbing. (Increased horizontal and longitudinal convexity of nail bed.)

No.	Sex	Age	Post-mortem Diagnosis
1	M	67	Massive left-sided empyema. Consolidation left lower and right upper lobes.
2	M	58	Chronic bronchitis. Left lower lobe bronchiectasis.
3	M	68	Emphysematous upper lobes. Left lower lobe bronchiectasis.
4	F	50	Mitral stenosis, right ventricular hypertrophy, old right lower lobe infarct.
5	F	28	Mitral stenosis, thrombosis of right lower lobe pulmonary artery.

*Group 2* with second-degree finger clubbing. (As above with thickening of nail base and obtuse angle between nail and proximal skin fold.)

6	M	48	Cerebral haemorrhage and multiple metastases.
7	M	61	Carcinoma right middle lobe. Secondary growth in right second rib.
8	M	53	Carcinoma of right upper lobe bronchus.
9	M	55	Bronchiectasis of right lower, middle and left lower lobes.
10	M	48	Mitral and aortic disease and right and left lower lobe infarction.
11	M	62	Right upper lobe fibrocaseous tuberculosis, right lower lobe bronchopneumonia and left lower lobe atelectasis.

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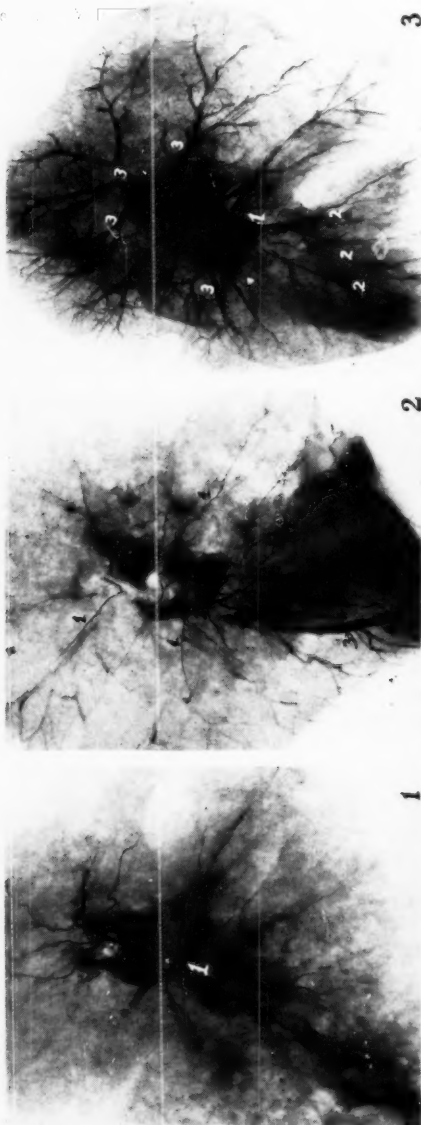


FIG. 1.—Lateral radiograph of a normal left lung.

Normal bronchial arteries radiate from hilar and peripheral areas to the lung periphery. (Hilum faces X-ray tube, 4th of normal size.)

Reproduced by permission of the Editors of "Thorax."

FIG. 2.—Lateral radiograph of left lower and part of left upper lobes.

Case 2. (Left lower lobe was found to be bronchiectatic.)

1. Normal bronchial arteries.
2. Enlarged bronchial arteries to left lower lobe.
3. Pulmonary artery in left posterior basal segment.
4. Site of precapillary anastomoses. (Hilum faces X-ray tube, 4th normal size.)

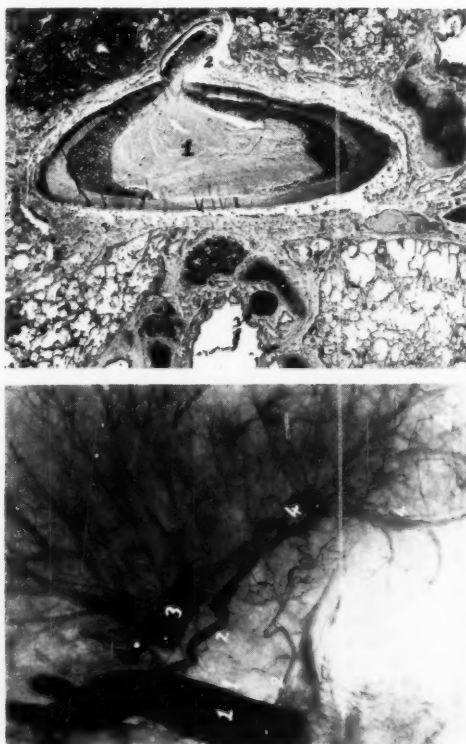


FIG. 3.—Lateral radiograph of left lung.

Case 10. (Rheumatic carditis with bilateral pulmonary infarction.)

1. Occluded branch of pulmonary artery to left lower lobe.
2. Enlarged vasa vasorum (derived from the bronchial arteries) vascularising occluded pulmonary artery branch, thus also filling pulmonary artery proximal to the occlusion.
3. Pulmonary artery in left upper lobe which has filled retrogradely. (Left hilum faces X-ray tube, 4th normal size.)

FIG. 4.—Postero-anterior radiograph of left lower lobe.

Case 13. (Chronic bronchitis with severe cor pulmonale.)

1. Aorta.
2. Very large left bronchial arteries.
3. Pulmonary artery.
4. Sites of anastomoses. (4th of normal size.)

FIG. 5.—Photomicrograph of occluded pulmonary artery in right lower lobe.

Case 4.

1. Pulmonary artery.
2. Bronchiole, arteriole communicating with partially occluded pulmonary artery and conveying granular bismuth medium into remaining lumen.
3. Normal bronchial artery. (Hilum faces X-ray tube, 4th of normal size.)

Group 3 with third-degree finger clubbing (Frank "drumstick" appearance of terminal phalanx).

No.	Sex	Age	Post-mortem Diagnosis
12	F	3	Transposition of the great vessels. Intraventricular septal defect, large bronchial arteries, patent pulmonary arteries, minimal deformity of pulmonary valve.
13	M	38	Interalveolar fibrosis, extensive broncho-pulmonary anastomoses, marked right ventricular hypertrophy.

Group 4 with no clubbing.

14	M	60	Very small primary tumour at right apex.
15	F	57	Small primary tumour from right posterior basal bronchus, secondary tumour in right anterior basal segment.

## Results

### Radiographic Findings

The striking radiographic feature in the lungs of Groups 1, 2 and 3 was the presence of variable degrees of broncho-pulmonary anastomoses. Of the cases of Group 1 three showed left and two right lower lobe anastomoses. In Group 2 no constancy in the lobar distribution of the anastomoses could be demonstrated. They were present in all but the sixth case. In the remaining five cases they were seen near the tumours and in the lobes affected by bronchiectasis, broncho-pneumonia or infarction.

In the two cases of Group 3 extensive bilateral broncho-pulmonary anastomoses were present in both lung fields.

In Group 4 no anastomoses were observed near the tumours.

### Microscopical Examination

The nature of the broncho-pulmonary anastomoses, which were seen in the radiograms of the first three groups, was of the same type. With the exception of Case 12, the pulmonary arteries were occluded proximal to the sites of anastomoses. The histological nature of the occlusions in nine instances suggested thrombosis or proliferative changes in the intima. In Cases 8 and 9 the vessels were occluded by clusters of malignant cells.

### Nature of Broncho-pulmonary Anastomoses

Immediately beyond the occluded lumina, dilatation of the vasa vasorum in the adventitial coats of the pulmonary arteries became apparent. These arterioles, normally over 100 $\mu$  in diameter, are branches of the bronchial arteries (Miller, 1947; Cudkowicz and Armstrong, 1951). They penetrated the medial coats, which is not usual, and recanalised the occluded lumina, thus establishing continuity between themselves and the patent peripheral pulmonary arterioles (Fig. 5). These anastomoses conveyed the injection medium, which was introduced into the bronchial arteries via the aorta, into the peripheral pulmonary arteries and also back into the proximal pulmonary arterial trunks, according to the degree of recanalisation that had taken place in that direction. No other type of anastomoses was seen. With the establishment of anastomoses through dilated vasa vasorum, the proximal bronchial arteries became considerably enlarged, whereas the smaller peripheral bronchial artery branches, which are normally extensively distributed throughout the whole lung and visceral

pleura, showed medial hypertrophy and narrowing of their lumina, suggesting that they were in a state of spasm or reduced function.

In the twelfth case the anastomoses were of the same pattern. Patent and enlarged vasa vasorum were in free communication with patent pulmonary arteries. The intrapulmonary distribution of the bronchial arteries was normal, and there was considerable enlargement of the diameter of the bronchial arteries as they emerged from the aorta. This case has been fully described elsewhere (Cudkowicz and Armstrong, 1952).

### Discussion

The present study suggests that in a diverse number of intrathoracic diseases which are associated with variable degrees of finger clubbing a uniform circulatory disturbance exists in the pulmonary circulation in the nature of precapillary broncho-pulmonary anastomoses. The relationship between the degree of finger clubbing and the extent of vascular disturbance seems to be only apparent, since unilobar broncho-pulmonary anastomoses were associated with bilateral finger changes, contrasted with unilateral clubbing seen, for instance, in axillary arterio-venous aneurysms (Cross and Wilson, 1950). It would appear that bilateral broncho-pulmonary anastomoses are related to a more severe degree of finger clubbing.

Pre-capillary anastomoses between the two circulations are of pathological significance, and there is no real evidence that they occur in normal lungs (Miller, 1947; Cudkowicz and Armstrong, 1951). The existence of capillary anastomoses is certainly a possibility but, hitherto, they have not been histologically demonstrated. Liebow and colleagues (1949) demonstrated broncho-pulmonary anastomoses in bronchiectatic lungs with the aid of a cast technique. Gilroy *et al.* (1951) found arterial blood in the pulmonary arteries of collapsed lobes at operation prior to lobectomy. This observation in living lungs strongly suggests that the increased oxygen saturation was due to the presence of bronchial arterial blood in the pulmonary arteries.

Whether clubbing can be related to the presence of these broncho-pulmonary anastomoses is, of course, uncertain in view of its presence in such diseases as cirrhosis of the liver. In acquired lung diseases clubbing is a frequent early manifestation and becomes reversible on the excision or cure of the disease. Ellman (1952) reports the dramatic improvement in pulmonary arthropathy within forty-eight hours of a right pneumonectomy for a primary bronchial carcinoma. The clubbing associated with congenital heart disease, according to Wilson (1952), may be influenced by a Blalock operation, and the unilateral improvement recorded was on the same side as the Blalock anastomosis.

The present observations suggest that in some diseases of the lung clubbing and broncho-pulmonary anastomoses co-exist. The stimulus required for the production of broncho-pulmonary anastomoses was believed to be the result of a lowering of pulmonary artery pressure or an inadequate pulmonary arterial blood flow (Karsner and Ash, 1912; Ghoreyeb and Karsner, 1913). The histological examination of the lungs in the present cases in which these anastomoses were seen radiographically showed occlusions of major branches of the pulmonary arteries in all except the twelfth case. This was of particular interest in the cases of mitral stenosis, in which clubbing is not commonly seen.

With the establishment of pre-capillary broncho-pulmonary anastomoses, subsequent to pulmonary artery occlusion, diversion of bronchial arterial blood flow into the low-pressure pulmonary artery bed takes place distal to these occlusions. Such diversion of bronchial artery blood flow is accompanied by hyperplasia of the walls of the bronchial arteries in their normal peripheral pulmonary distribution (Cudkowicz and Armstrong, 1953), suggesting a state of spasm and reduced function. Larsell and Dow (1933) emphasised that intrapulmonary nerves and plexi have only a bronchial arterial blood supply. These nervous structures are intimately connected with the bronchial arteries alone and accompany them throughout their intrapulmonary course. This close relationship between the bronchial circulation and the pulmonary innervation was particularly stressed by Daly and Von Euler (1933). Bruner and Schmidt (1947) have shown that cholinergic dilator and adrenergic constrictor fibres reach the bronchial circulation. Cournand (1950), Von Euler and Liljestrand (1946) found no evidence of a similar innervation of the *peripheral* pulmonary arteries and thought that the spasm in these vessels in pulmonary hypertension must be the result of a direct humoral action. It is perhaps noteworthy that the sympathetic efferent fibres for both the thoracic viscera and the upper limb vasculature share the third and fourth thoracic segments of the cord (Wright, 1952). It is conceivable, therefore, that in chest disorders leading to the formation of broncho-pulmonary anastomoses anti-dromic impulses from the peripheral nerve fibres of the lung, which have been rendered ischaemic by the deviation of bronchial arterial blood flow, reflexly influence the formation of the arterio-venous anastomoses in the limbs as described by Lovell (1950).

### Summary

The bronchial circulation was examined in a variety of chest diseases accompanied by finger clubbing. In twelve instances pre-capillary broncho-pulmonary anastomoses were found. These broncho-pulmonary anastomoses resembled the vascular anastomoses which have been described in clubbed fingers.

We wish to thank Professor J. McMichael and Professor J. Dible for the provision of facilities in their respective departments; Dr. J. Crofton and Dr. B. Lennox for their encouragement; the technical staff of the Department of Pathology, Mr. E. V. Willmott for the photomicrograph and Mr. K. G. Moreman, for the reproduction of the radiographs.

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## THYROID ENLARGEMENT DURING P.A.S. THERAPY

BY T. W. DAVIES, D. B. MORGAN AND J. H. THOMAS

From the Chest Clinic, Swansea

P.A.S. is widely used, with streptomycin, in the treatment of tuberculosis and a large number of side effects are attributed to it. Many of these are probably of an allergic nature but others may well be caused by toxicity although positive proof is lacking. The following are described: gastro-enterological upset (nausea, abdominal pain, vomiting, diarrhoea), fever, rashes which may lead to exfoliation, adenopathy, photophobia, conjunctivitis, renal manifestations (hæmaturia, albuminuria, anuria), joint pains, peripheral neuritis, liver damage, prolonged coagulation time, hypo-prothrombinæmia, reduced capillary resistance, purpura, lowered blood potassium, cardiac irregularities, muscular weakness, and alteration of the blood lipase. To this list is now added thyroid enlargement, with or without myxœdema, probably due to the anti-thyroid effect of the drug. Kombrower (1951) described one case, Clausen and Kjerulf-Jensen (1951) three cases, and Hamilton (1953) one case where this complication developed. We have seen two such cases within the past year and feel that they are worthy of publication.

## CASE 1

First seen in 1940 when 8 years of age with a well-calcified primary complex in the right lung. In 1949 bilateral apical infiltration developed which responded to bed rest. Returned to work in January 1951.

X-ray in April 1952 showed re-activation of the disease in the right upper zone. Bed rest was instituted, supplemented by streptomycin hydrochloride (1 G. daily) and P.A.S. (18 G. daily in six divided doses) on April 30. He completed the course of 90 G. streptomycin and 1,404 G. P.A.S. on August 3.

When seen on August 6 there was obvious enlargement of the thyroid gland without clinical evidence of thyrotoxicosis or myxœdema. The enlargement was generalised and of the type encountered during thiouracil medication. The swelling had become apparent to the patient fourteen days previously—*i.e.*, eleven days before cessation of the P.A.S. (1,242 G. having been taken). The only complaint was irritability. The enlargement disappeared by October 29—*i.e.*, seventy-seven days after cessation of the drug. Clinical progress was satisfactory and the weight gain not unduly high.

## CASE 2

A female, aged 32 years, was first seen in September 1952 with advanced bilateral respiratory tuberculosis. Slight enlargement of the thyroid gland had been present for about four years without evidence of endocrine disturbance.

Bed rest was immediately instituted and she commenced treatment with streptomycin (1 G. daily) and P.A.S. (18 G. daily in six divided doses) on September 4. When seen on October 3 there were no side effects but on her next visit on November 3, after 990 G. P.A.S., the thyroid gland was markedly

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enlarged. There was no clinical evidence of myxœdema although she had gained 18 lb. in weight. The blood cholesterol was within normal limits and E.C.G. recording normal. Chemotherapy was continued and she completed the course of 90 G. streptomycin with 1,404 G. P.A.S. on December 17. Although the thyroid showed further increase in size there was no evidence of either myxœdema or tracheal compression.

Following cessation of chemotherapy the thyroid became smaller but did not return to its original size until March 23—*i.e.*, ninety-six days after cessation of P.A.S. therapy.

Clinical progress was unsatisfactory. Initially there was a gain in weight and clearing of the infiltration but later a cavity developed in the right lower lobe which has remained very resistant to treatment.

In our opinion thyroid enlargement in no way influenced the clinical course, the unsatisfactory progress being entirely due to the advanced stage of the disease when first seen.

### Discussion

The significant feature in our cases is that the complication developed during therapy with streptomycin and P.A.S. in the accepted dosage. In the case described by Kombrower (1951) and two of the three cases described by Clausen and Kjerulf-Jensen (1951) much larger doses were given (*viz.*, 3,210 G. over nine months, 2,892 G. over seven months, 6,276 G. over sixteen months).

The third case differed in that thyroid enlargement developed in a girl of 18 after only a month of P.A.S. therapy (14 G. daily).

Hamilton (1953) noted this side effect in a young man aged 19 after only three days of P.A.S. (7.5 G. daily). The gland continued to increase until the seventeenth day when the drug was discontinued owing to intolerance. Two unsuccessful attempts were made at a later date to continue the drug with the addition of thyroid. The duration of this treatment (three days on the first occasion, and seven days on the second) is in our opinion too short for assessment as to the value of this combination in the prevention of thyroid enlargement.

In all these cases the thyroid returned to its former size after P.A.S. was discontinued and, therefore, it can be inferred that the changes in the gland are reversible. The time interval, however, varied. Kombrower, Clausen and Kjerulf-Jensen, and Hamilton maintained that this was complete within a month but our cases took considerably longer (seventy-seven days in the first case and ninety-six days in the second).

The problem was investigated experimentally by Kjerulf-Jensen and Wolfbrandt (1951). They found that in mice, rats and rabbits P-amino-salicylic acid and P-amino-phenol (one of its breakdown products in the body) induced thyroid hyperplasia, histologically comparable with that induced by thiouracil although about one hundred times the dosage was necessary to produce the same effect. This was abolished by simultaneous administration of dried thyroid tissue but not by sodium iodide. Horne and Bogesch (1950) state that one molecule of P.A.S. binds three atoms of iodine *in vitro*. This could prevent iodisation of tyrosine and interfere with the production of thyroxine.

The Norwegian authors stress that the thyroid hyperplasia, even if it leads to myxœdema, has no deleterious effect on the tuberculous disease process

as such. We agree with this contention, but feel that it must be taken into consideration when assessing clinical improvement with the drug, as gain in weight may be due partly, in some cases, to this anti-thyroid effect and its resultant water retention.

Furthermore, care should be taken in prescribing the drug to patients with thyroid enlargement, particularly when there is retrosternal extension. In one of the cases of Clausen and Kjerulf-Jensen (1951) tracheal compression developed although not of sufficient severity to warrant interference.

### Summary

(1) Two cases developing thyroid enlargement during routine therapy with P.A.S. are described. Clinical progress was unaffected.

(2) The opinion is given that the anti-thyroid effect of P.A.S. should be taken into consideration when assessing improvement as judged by gain in weight.

(3) It is suggested that care is taken when prescribing P.A.S. to patients with thyroid enlargement.

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## REVIEWS OF BOOKS

*Diseases of the Chest.* By T. ROYLE DAWBER, A.B., M.D., F.A.C.P.; Senior Surgeon U.S.P.H.S.; Chief of Heart Disease Epidemiology Study, National Heart Institute; Assistant in Medicine, Harvard Medical School; and LLOYD E. HAWES, A.B., M.D., D.A.B.R.; Radiologist at Faulkner Hospital; Consultant at U.S.P.H.S. Hospital, Boston. London: Baillière, Tindall and Cox. 1953. Pp. 440. Price 76s. 6d.

In this book emphasis is laid on the importance of co-operation between the clinician and the roentgenologist in the study of diseases of the chest, so much so that the pages are equally divided between X-ray reproductions and description of diseases. The book is intended for "the student, resident physicians and practitioners of medicine whose time is to a great extent occupied with diseases involving the thoracic cage."

Great stress is laid on the value of X-ray examination; indeed the authors consider that "roentgen studies" rank second only to the "history" in the clinical examination of the patient. The description of the physical signs is often brief, and the book in consequence lacks the completeness which is required by the medical student. For instance, to mention a few omissions, in the fifty pages given to the description of diseases of the heart there are no electrocardiograms, and no description of cardiac catheterisation or of angiocardigraphy. The surgical treatment of mitral stenosis is not discussed. On the other hand, many of the descriptions of the lung diseases are excellent and up to date—but here again there is no mention of isoniazid in the treatment of pulmonary tuberculosis. Despite these various lacunæ, the book is written in a pleasing style, it is easy to read, very well produced, and will form a useful addition to the chest physicians' library.

G. E. BEAUMONT.

*The Classification of Pulmonary Tuberculosis.* By MILOSH SEKULICH, M.D. London: William Heinemann, Medical Books, Ltd. 1953. Pp. 322. Illustrated. Price 63s.

The number of classifications of pulmonary tuberculosis is testimony to their inadequacy and there is still room for the perfect classification. The recently proposed international digit code which goes a long way to meeting requirements is not mentioned in the detailed historical survey given in this book.

In many ways the title of the book is misleading as, in addition to expounding his classification the author devotes sections of varying length to the pathogenesis, clinical characteristics, and treatment of the various types. The book thus becomes a small manual of pulmonary tuberculosis and contains much useful information which is not always available in more pretentious publications. These sections are, however, subsidiary to the main thesis. They are not detailed, but they are concise and useful and their elaboration of the subject makes it possible for the author to expand what is, in effect, a small subject into a small and useful text-book.

The classification itself is made under four main headings of inflammatory,

caseous, fibro-caseous and fibrous. The first two are types of the primary infection, the third is bronchogenic tuberculosis, and the fourth is a group of hamatogenous origin. Each is sub-divided into several categories which cover all clinical and pathological types of the disease. Other headings in the classification deal with extent of the disease in zones, its activity under the main headings of active and inactive, and the bacteriological state of the sputum. This is classed merely as positive or negative. No provision is made for details of the examinations made to exclude the presence of tubercle bacilli or for the complications of the disease which are discussed in a later section. One hundred and forty eight excellent X-ray film reproductions illustrate the various categories and types of the disease as interpreted in the classification. Most of these follow the patient throughout his illness and show the gradation of classification from one category to another, progressive or regressive as the case may be.

There is much in this classification which will appeal to the clinician and will make him think accurately, as he ought to do, in terms of factual pathology and of the patient himself. As a universal system among practising physicians there is much in its favour but the thirty possible categories are cumbrous, and as an international classification it is unlikely to compete with the digit code. Despite this the book is a thoughtful contribution to our knowledge and it can be recommended not only for the stimulus of the classification itself but for the lucid sections on pathogenesis and pathology. Dr. Sekulich has knowledge and enthusiasm and his venture merits success.

CHARLES CAMERON.

*Pulmonary Tuberculosis.* By W. PAGEL, F. A. H. SIMMONDS and N. MACDONALD. Oxford University Press. Pp. 742. Illus. 317. Price 84s.

This Third Edition, after an interval of three years, of the now well-known text-book of Kayne, Pagel and O'Shaughnessy's *Pulmonary Tuberculosis*, has been largely rewritten to keep in line with the great advances that have been made in the treatment of pulmonary tuberculosis in both the medical and surgical spheres. The results achieved demonstrate close co-operation between the three authors who have succeeded in integrating their particular contributions.

It may well be asked whether such unification has not been made at the expense of individual thought and exposition.

The sections on Pathology as well as the Clinical sections have been very completely revised in the light of Pagel's unique resection specimens and post-mortem material; his views on the pathology of bronchogenic tuberculosis have undergone complete revision. Moreover, the clinical aspects have been revised to fit in with morbid anatomical studies representing the evolution of tuberculosis as a general disease.

There will be general acceptance of the evolution of tuberculosis in man into Pagel's three types, namely:

- (1) Primary Infection.
- (2) Hæmatogenous Dissemination.
- (3) Lesions limited to the Lungs.

When, however, we come to examine the chapters devoted to each type of

lesion differences of opinion are permissible, although the basic similarity between primary tuberculosis in childhood and adults will be generally accepted.

The usual fate of the primary focus is calcification, and some calcified foci may, as Pagel clearly shows, even go on to ossification.

This work shows conclusively that upon the severity of the primary infection depends the size of the primary focus and the presence of caseation and cavitation both in childhood and adults.

*Post Primary Tuberculosis*, as Lyle Cummins has repeatedly shown, may be generalised, involving more than one organ or localised to the lungs. Pagel states that if we divide post primary tuberculosis into generalised (hæmatogenous dissemination) and localised or what he now calls "bronchogenic," we are following the fundamental scheme of evolution. His disseminated tuberculosis, which can be differentiated from "bronchogenic tuberculosis," covers such forms as acute miliary tuberculosis, acute caseous forms of generalised tuberculosis, chronic disseminated tuberculosis not necessarily confined to the lungs and abortive dissemination, which may be clinically latent.

*Bronchogenic Post Primary Tuberculosis* differs, according to the writers, from (a) primary tuberculosis, where usually one focus develops in the lungs and the corresponding lymph nodes are involved, and (b) disseminated tuberculosis in that it is restricted to the lungs and the sputum drainage channels (larynx, intestine) and the condition progresses by producing lung destruction by transmission of the bacilli along the bronchi; hence the term.

From the clinical, radiological and pathological viewpoints the question is set when a case of pulmonary tuberculosis is detected, to which stage in the evolution of tuberculosis does a particular lesion belong? Is it primary, hæmatogenous or bronchogenic? And from the point of view of activity, is it healed, is it active (unstable), or is it latent?

Their concept of a tuberculous lesion is certainly both intelligent and convincing and should make an appeal to the thoughtful clinician, anxious to treat and understand his patient as a whole both from the preventive and therapeutic aspects. Moreover, he can study the patient's lesion and its repercussions on the individual and the community.

It is a pleasure to read this book. It is lucidly written, beautifully illustrated with a profusion of post-operative and autopsy specimens of lungs in various stages of disease. The X-ray illustrations are perfect in detail. For the most part the X-ray photographs are reproduced as positive prints. There are, however, a number of negative prints. It is debatable which are preferable, but having decided on one or the other, it should be adhered to throughout.

The expert clinician who is in search of a comprehensive modern work dealing with the newer concepts of pathology, diagnosis and treatment, will find in this book a fund of information. On the debit side, however, he will regret the relatively meagre space allotted to epidemiology and prevention.

*Pulmonary Tuberculosis. A Handbook for Students and Practitioners.* By R. Y. KEERS and B. G. RIGDEN. With a New Foreword by F. H. Young. Edinburgh: E. & S. Livingstone Ltd. Pp. 324. Illus. 150. Price 24s.

This handbook, in its completely revised Third Edition, is a model of precision and conciseness. It is, in fact, a miniature version of Pagel, Simmonds

and Macdonald's book and, whilst the former is admirably suited to the medical student and practitioner, the latter is a manual for the expert.

It is astonishing how much up-to-date information is to be found in this small handbook, designed to describe, as briefly as possible, the position of pulmonary tuberculosis to-day. In the six years since the appearance of the Second Edition much has had to be rewritten and has been most successfully done. All the recent advances in the pathology, epidemiology, diagnosis, treatment, after-care and prevention are adequately surveyed. Modern views on chemotherapy, collapse therapy and thoracic surgery are discussed in a balanced manner which will be generally acceptable.

Numerous excellent illustrations add to the usefulness of the book, and of particular value are the X-ray illustrations—negative prints throughout—many accompanied by explanatory line diagrams which assist in interpreting the varied lung lesions.

Dr. F. H. Young in an appropriate foreword summarises the function of the book in a nutshell:

"In this small handbook the authors have tried to help the student to see pulmonary tuberculosis in a better perspective and have kept it small enough to get a comprehensive view without getting lost in a maze of detail."

We can thoroughly recommend this book to students and practitioners.

PHILIP ELLMAN.

*Famine Disease in German Concentration Camps; Complications and Sequels.* By PER HELWEG-LARSEN, HENRIK HOFFMEYER, JORGEN KIELER, EIGIL HESS THAYSEN, JORN HESS THAYSEN, PAUL THYGESEN, MUNKE HERTEL WULFF. Acta Psychiatrica et Neurologica Scandinavica, Suppl. 83 (also published as Supplement 274 to Volume 144 (1952) of Acta Medica Scandinavica). Price Dan. kr. 35.00.

The investigations which formed the material for this monograph mostly took place between 1947 and 1951. It can be said at once that the publication is one of the best, and best written, accounts of the clinical, psychological and sociological effects of conditions in concentration camps which has yet appeared.

The subjects of the report were in the main 1,282 Danes who had survived internment in German concentration camps. These comprised 572 members of the resistance movement and 710 police; additional information was collected on 197 subjects who were interned but, for various reasons, suffered appreciably less privation.

The report begins with an account of the conditions of deportation and the conditions existing in the concentration camps. Whilst written in a restrained and unemotional manner, it emphasises again—nor can it be done too often—the incredible inhumanity which was practised with systematic and calculated brutality by the Nazis. It clearly brings out the effect of these conditions on the moral integrity of the prisoners themselves, probably the most fearful result of all.

There follows an excellent and critical description of the diseases of famine, including cachexia, cedema, diarrhoea, cardiovascular changes and mental deterioration. These consolidate and amplify what has already been written on these conditions.



The last third of the book is concerned with the problems of repatriation and rehabilitation. These include a most informative, and in some respects disturbing, account of the somatic, psychiatric and social consequences of incarceration in concentration camps. As earlier workers have observed, true physical rehabilitation took much longer than was superficially apparent. "Repatriation neurosis" was severe in many cases and often developed only after a variable latent period.

Readers of this journal will be especially interested in the section on tuberculosis by P. Helweg-Larsen, which occupies some thirty pages of the book. Out of 1,331 ex-prisoners who were examined between 1945 and 1950, fifty-eight had signs of tuberculosis. It was three times more frequent amongst members of the resistance movement than amongst the police; this was no doubt due to the better diet of the police, who received Red Cross parcels. The effect of diet was also illustrated by the fact that the incidence was higher in those who lost most weight. Another important factor was the intensity of exposure to infection, since the diseases occurred more frequently in camps which had most overcrowding and worst sanitary conditions. The higher risk of infection showed itself by the fact that, even with a period of deportation of less than six months, twenty-seven out of thirty-two tuberculin-negative subjects had become tuberculin-positive. Pulmonary tuberculosis occurred more readily in these tuberculin-negative subjects; the rate was 15 per cent. of these, 9 per cent. in those who had been vaccinated with B.C.G. and 3 per cent. in those who had been tuberculin-positive.

Compared with the rate in corresponding age groups in Copenhagen during the same period, the frequency of tuberculosis was twelve and five times as high in the members of the resistance movement and in the police. It is of particular interest that one-third of the cases occurred only two to four years after repatriation.

The section on tuberculosis is exceptionally well presented and has a particularly good, well-arranged and adequately detailed summary.

JOHN YUDKIN.

*Pathologie et Structure Pulmonaires.* By H. WAREMBOURG, Professeur agrégé à la Faculté de Médecine de Lille; and P. GRAUX, Professeur agrégé à la Faculté de Médecine de Lille. Préface du Professeur Jean Minet. Paris: Masson et Cie, 1953. Price 2,500 Fr.

Although this book is officially a second edition, it has been rewritten and enlarged to such an extent that it might almost be considered as a new volume. In the main it consists of a valuable historical review, followed by a comprehensive description of the anatomy of the intrathoracic portion of the respiratory tract. The final section comprises a detailed consideration of the bearing of our recent understanding of the broncho-pulmonary structure on lung surgery, with special reference to segmental resection.

The foreword is devoted to a discussion on the nomenclature of the lung segments. An international committee put forward proposals in 1949 and the authors, following Lucien and Beau, criticise the conclusions of this committee, chiefly on the ground that the proposed descriptions of the lung segments could be applied only in terms of human anatomy. The discussion here ranges far from any point of interest to the chest clinician. Most French



writers prefer the terms "ventral" and "dorsal," because man is the only animal which walks erect, and these terms are more readily understood when other types of mammal are under discussion. Throughout the book they prefer this terminology.

The anatomical descriptions are clear, but the diagrams are often complicated and difficult to follow. The X-ray reproductions are not of the standard which one has come to expect from French publications.

In their conclusion the authors draw attention to the fact that, whereas disease is apt to affect most organs diffusely, the chief tendency in lung disease, especially in the earlier stages, is for the lesion to be strictly localised. This applies particularly in cases of tuberculosis, abscess, bronchiectasis and growth. This fact may have an important bearing on diagnosis, for different disease processes are apt to affect different segments. A clear conception of the anatomy of the bronchial system is obviously also essential when postural drainage is being considered.

Resection of a segment of the lung is an operation which has not been practised for very long, but it has obvious potentialities and it is likely to become the operation of choice in many cases of early lung disease. It cannot be carried out without a thorough understanding of the structure of the lung, and this book fulfils its function of providing the necessary information.

JAMES MAXWELL.

*Die Lungenresektionen.* By Prof. Dr. A. LEZIUS. Stuttgart: Georg Thieme Verlag. 1953. Pp. 143. Figs. 112. Price DM 49.80.

In this monograph on resection of the lung the author treats the subject principally from the technical side. Short introductory sections on the indications, pre-operative treatment and anaesthesia are given, and before going into a detailed description of the actual operations certain general observations such as the approach and closure of the bronchus stump are discussed in some detail.

The greater part of the book is concerned with the technical details of the individual operations. The removal of each lobe is considered separately, as also the excision of certain segments. Throughout the text there are numerous good illustrations, some of them outstanding, of the various stages of the operations. Inevitably they are more diagrammatic than found in actual practice, and it is rare for the surgeon to encounter so few adhesions, glands and matting at the hilum as is depicted.

The anatomical diagrams are most helpful, though the nomenclature does not always correspond with that in accepted use in this country, and there is hardly enough emphasis on the more common abnormalities.

Post-operative treatment and complications are discussed, though it would be useful to have had a much fuller account of this all-important section. Indeed, the book is essentially an illustrated description of the operations included under its title, and whereas it will prove of great value to the thoracic surgeon it can have only a limited attraction beyond that field.

The production is excellent and, as has been said, the illustrations are admirable and numerous.

T. HOLMES SELLORS.

*Probleme der Morphologie, Cytochemie und Wuchsform des Tuberkuloseerregers.* By F. J. BASSERMAN. Stuttgart: G. Thieme. 1953. Pp. iv+98. 40 illustrations. Price DM 7.80.

In this book the modern literature on the finer morphology, cytochemistry and types of growth of the tubercle bacillus has been compiled under the following headings: the variations in bacillary morphology, size, cellular surface, organisation of cytoplasm, acid fastness, the Gram staining, volutin granules (calcium metaphosphate-nucleoprotein-complexes), nucleic acid systems, various staining methods, Spengler's "splinters," mycelial growth, multiplication, cord formations, longitudinal fission, branching, granular forms and filterable forms. The author contributes occasionally critical remarks based on personal observations and comes to the conclusion that filterable forms have not yet been proven, but the question to him seems worth reopening. Although a large sector of the literature has been covered, certain problems have not been touched upon by the author. For example, the variability of tubercle bacilli as conditioned by tissue response; this particularly applies to the occurrence (in Giemsa sections) of "eosinophilic"—i.e., not fully acid-fast—bacilli, in recrudescence and in the tissue response of the naturally resistant animal, notably the mouse (*J. Path. Bact.*, 1934, **39**, 689; *Am. Rev. Tuberc.*, 1940, **42**, 58; *ibid.*, 1952, **65**, 673). The morphological variability of the bacillus as evident in microscopic sections through cultures has also been ignored, and so have the important observations of Lominski (*Zentralbl. f. Bakteriol.*, I, 1933, cxxviii, 276), Soltys and Taylor (*J. Path. Bact.*, 1944, **56**, 173), and others.

In view of the uncritical, widespread enthusiasm for a so-called "cyclical" reproduction of the tubercle bacillus, the paper by Lack and Tanner (*Journal of General Microbiology*, Vol. 8, 1953, p. 18) should have been quoted, as it is shown here that no life cycle can be observed, but only a regression due to autolysis.

WALTER PAGEL.

#### Correction

On page 183 of Number 3, Volume XLVII, we published a review of "Ergebnisse der gesamten Tuberkuloseforschung Band XI." Unfortunately, this was referred to as Volume II instead of Volume XI. The publishers have asked us to point out this error, since Volume II is, of course, part of the existing series.

## BOOKS RECEIVED

The following books have been received and reviews of some of them will appear in subsequent issues:

- Modern Trends in Diagnostic Radiology, Second Series (1953)*. Ed. by J. W. McLaren. Butterworth and Co. (Publishers) Ltd. Pp. xii+394+Index. Illus. 367. 70s.
- A Practice of Thoracic Surgery*. By A. L. d'Abreu, O.B.E., Ch.M., F.R.C.S. 1953. London: Edward Arnold and Co. Crown 4to. Pp. viii+591, 343 illus. Price £4.
- Hormonal and Neurogenic Cardiovascular Disorders*. By Wilhelm Raab, M.D. Pp. xxi+722 with 82 illus. 1953. London: Baillière, Tindall and Cox. Price 114s.
- Tuberculosis Index and Abstracts of Current Literature Quarterly*. June, 1953, Vol. 8, No. 2. N.A.P.T. Price 25s. per year 5\$.
- Traité de Phtisiologie*. By Jacques Stephani. 1953. Paris: Amedée Legrand et Cie. Pp. 908. Illus. 306. 5,300 francs.
- Phtisiologie du Médecin Praticien*. By M. Bariéty and G. Brouet. 1953. Paris: Masson et Cie. Pp. 508. Figs. 220. 1,450 francs.
- Die Wirbelsäulentuberkulose und ihre Differentialdiagnose*. By Dr. J. E. W. Brocher. 1953. XII. Stuttgart: George Thieme Verlag. Pp. 272. Illus. 376. DM 78.
- Health Horizon*. Summer, 1953. N.A.P.T. Pp. 56, with Illus. Quarterly. 2s. 6d.
- Tuberculosis Control in Manitoba, 1952*. Annual Report of the Sanatorium Board of Manitoba. Pp. 48. Illus.
- Forty-ninth Annual Report of Toronto Hospital (for Tuberculosis), Weston, Ontario, for 1952*. National Sanitarium Assn. Pp. 80.
- Northamptonshire County Council—Annual Report of the Medical Officer of Health for the Year, 1952*. 1953. Stanley L. Hunt (Printers) Ltd. Pp. 83.
- Transactions of the Twelfth Conference on the Chemotherapy of Tuberculosis, February, 1953*. Prepared and edited by the Veterans Administration. Pp. i-vii+430.

## REPORTS

*Royal Victoria Hospital Tuberculosis Trust for the Care and Prevention of Tuberculosis throughout Scotland.*

WE have just received the Annual Report for the year ending June 1952. Among its observations are the following:

During the year covered by this Report it was decided that a contribution could be made in the field of research, and the Trust has undertaken financial responsibility for two schemes, one connected with the use of miniature X-ray photography and the other with the use of isonicotinic acid hydrazide and with the chemotherapy of tuberculosis.

The tuberculosis position, so far as mortality is concerned, shows striking progress. In 1951 the mortality rate per 100,000 of the population from respiratory tuberculosis was 37 (1,884 deaths), as compared with 66 (3,415 deaths) in 1948. This represents a drop in three years of no less than 44 per cent. For all forms of tuberculosis the figures represent a decrease of mortality of 43 per cent. over the same period. Even more important, the mortality from respiratory tuberculosis in the vulnerable age groups is now falling rapidly. For instance, the number of deaths in men aged 35-54 was 413 in 1951 as against 655 two years ago. For women aged 15-34 the figures were 417 and 993 respectively. These are impressive figures and reflect great credit on the tuberculosis services of the country. Nevertheless, as the Committee pointed out last year, these figures must be interpreted with some reservation so long as the disease itself remains widespread.

Furthermore, the mortality figures of recent years should be examined in relation to the broad epidemic curve over a much longer period of time. Tuberculosis is very sensitive to adverse socio-economic factors. Thus it would appear that with a gradual return to normal conditions we are now witnessing a period of accelerating fall in mortality similar to but more pronounced than that after World War I. The fall in mortality following World War II has been much more rapid than that associated with World War I, owing to the improvement in socio-economic conditions coinciding with rapidly advancing medical progress in relation to case-finding and treatment.

But the fact remains that, despite recent spectacular trends, we have not yet made up the lost ground, and have not reached the low record in mortality which would have been attained by this time had there been no war.

The other aspect of tuberculosis which the Committee have always stressed relates to the notification of new cases, which is, from the point of view of public health, more important than the number of deaths. The figures for new cases since 1948 are as under:

RESPIRATORY				NON-RESPIRATORY			
		Number	Rate per 100,000 of population		Number	Rate per 100,000 of population	
1948	..	..	8204	159	1842	36	
1949	..	..	8653	167	1647	32	
1950	..	..	8135	157	1546	30	
1951	..	..	7875	154	1470	29	

Thus, during the same period in which the death rate from respiratory tuberculosis diminished by 44 per cent., the number of newly discovered

notified diminished by only about 3 per cent. This annual notification rate, apart from the "crisis years" of 1947-50, is greater than anything recorded since 1914-18. Better diagnostic measures are, of course, bringing more cases to light, which makes a true comparison with the corresponding rates of thirty years ago impossible, but the figures prove that tuberculosis is still a widespread and serious problem.

The combination of earlier diagnosis, more efficient treatment and improving conditions results in a decreasing death rate, which carries with it the assumption that many sufferers have been cured. It should also be remembered, however, that the majority of patients leaving hospital are not yet completely cured and require medical and social after-care for considerable periods of time. Year by year the survival rate is increasing, and with it the number of people who are the subjects of tuberculosis, and who require skilled supervision if clinical relapse of the disease is to be avoided. The actual figures are of interest. The number of persons in Scotland known to be the subject of respiratory tuberculosis in 1946 was 26,525. The corresponding number for 1950 (the latest available figure) was 34,693, an increase of 32 per cent. This increased survival trend may well become even more pronounced as the effects of the sharply diminishing death rate become more obvious.

The question of relapse is one which for some time is going to cause increasing concern to tuberculosis physicians. The years 1948-49 saw the peak of the increase in tuberculosis morbidity and mortality. As a means of combating the problem the Department of Health recommended Regional Hospital Boards to reduce the duration of the patients' stay in hospital whenever circumstances should permit. This course was a natural one to recommend under the circumstances then prevailing. But no matter how carefully such a policy was carried into effect, the risks of relapse following a shortened period of sanatorium treatment were inevitably increased, and, in fact, the Committee have reason to believe that where this policy was followed the relapse rate amongst discharged patients is at present increasing.

A further aspect of the problem which published figures do not necessarily show concerns the changing emphasis from the child to the young adult. Twenty-five years ago it was stated that attention must be increasingly focused on the child to detect the first manifestations of tuberculous infection. This was a measure especially associated with the name of Sir Robert Philip. The policy was so successful that the first infection with the tuberculosis germ, which most people acquire naturally sooner or later, was postponed with increasing frequency from infancy to childhood, and from childhood to adolescence and early adult life. Now the postponing of infection from infancy to childhood was all to the good. But the further postponing of infection from school age to adolescence and early adult life has brought a new problem, for we now know that it is actually more dangerous to acquire this infection in adolescence and adult life than it was at school age. Yet another clinical problem is, therefore, developing.

These epidemiological and clinical considerations lead the Committee to stress once again that much remains to be done, and to repeat the warning given in their Report for 1949-50 that the decrease in the disease "will be progressive only if unremitting pressure is brought to bear upon it."

Whether this unremitting pressure is at present adequate seems doubtful. If the aim of the country is to reduce tuberculosis, progress must be regarded as good. But if the aim is eradication of the disease, progress must be regarded otherwise. It seems to the Committee that the time has come when the country

must decide whether it can afford to adopt as a tuberculosis slogan "Eradication not Reduction."

#### RESEARCH

*Chemotherapy in Tuberculosis.*—Notable advances have been made in recent years in the treatment of tuberculosis. The aim of chemotherapy is to kill the tubercle bacilli in the tissues of the host, or, alternatively, so to injure the bacilli that they become more vulnerable to the host's natural defences. The most important of the present chemotherapeutic agents is, of course, streptomycin. But recently a new substance, isonicotinic acid hydrazide, has been evolved and is being closely studied. These matters, and other fundamental research in chemotherapy, are being investigated by Professor Crofton of the Chair of Tuberculosis at Edinburgh University with the aid of a grant from this Trust.

It is not yet possible to offer any comments on the value of isonicotinic acid hydrazide, but in view of published reports in the lay press, particularly those originating in the United States, making extravagant claims for the drug, the Committee feel it wise to utter a word of caution. In their long experience the Committee have seen many new drugs appear and disappear, and untimely publication of preliminary results in the lay press has often raised false hopes. The interim report of the Medical Research Council, based on the work in progress in various British institutions, has therefore been received with great interest. From this Report it appears that the early results of treatment are approximately as favourable as the best chemotherapy hitherto devised. But after three months the drug ceases to have any effect on the tuberculosis germs in 71 per cent. of the cases treated. The Medical Research Council regard this as a serious problem, and are studying the effects of combining isonicotinic acid hydrazide with other drugs.

*Miniature Radiography.*—One of the technical advances in chest radiography has been the development of miniature films. One such is known as Mass Miniature Radiography, and is of proved value in finding all kinds of chest abnormalities. More recently another type of process employing 70-mm. films has been developed and may have wider application than diagnostic case-finding. If so, this may prove to be of great importance. The Trust (with the co-operation of the Dumfries and Galloway Hospital Management Board) has installed the necessary equipment in Lochmaben Sanatorium, where investigations on the subject are proceeding. The results will be co-ordinated with those of similar inquiries in progress in two other countries.

#### URINARY TUBERCULOSIS

*(Abstract of a discussion at the Ninth Annual Meeting of the British Association of Urological Surgeons held at Leeds, June 26, 1953.)*

A DETAILED analysis and review of 722 cases of urinary tuberculosis (contributed in response to a questionnaire by members of the Association) was given by Mr. J. Cosbie Ross (Liverpool) who compared the findings with those of a personal series of 165 patients treated at Wrightington Sanatorium. The collective series was drawn from the two-year period 1937-38 (268 cases) and from a similar post-war period 1947-48 (454 cases) thus allowing for a five-year review of the more recent group.



Before making any comparison Mr. Cosbie Ross emphasised that there was no reliable statistical evidence that urinary tuberculosis was a disappearing disease. In fact, in his experience the number of cases had increased with the application of more thorough methods of diagnosis. Comparing cases from 1937-38 and 1947-48 it appeared that the average age at diagnosis was somewhat higher in the more recent period (33 as against 31 years), males being slightly older than females. Cases were classified according to the severity and extent of the disease as follows:

- Type 1. Early minimal lesions of the renal parenchyma.
- Type 2. Unilateral renal lesions with cystitis (treated by nephrectomy).
- Type 3. Bilateral renal lesions with cystitis (treated by nephrectomy).
- Type 4. Cystitis and involvement of the remaining kidney (after nephrectomy).
- Type 5. Major bilateral disease.

In both periods under review the bulk of the cases were of Type 2, and in over 75 per cent. of the entire series disease of the urinary tract afforded the principle evidence of tuberculosis. The incidence of presenting symptoms was then discussed and it was noted that over half the males had genital lesions. Methods of diagnosis were reviewed and attention drawn to the fact that normal pyelographic findings were present in only 7.5 per cent. of the series. Over 50 per cent. of cases in which the radiographic appearance of the bladder was described showed shrinkage or irregularity, but conversely many cases with normal cystograms showed widespread disease on cystoscopy. No surgical treatment was performed in 134 cases (mainly Types 1 and 5) whereas nephrectomy (including partial nephrectomy) (288 cases), and nephro-ureterectomy (171 cases) were the most frequently employed operative procedures in the remainder. The incidence of post-operative complications (discharging wounds and sinuses) was significantly less in sanatorium cases than in those dealt with in hospital. Symptomatic improvement was recorded in at least 43 per cent. of the entire series while many others whose records were incomplete were doubtless improved. Survival rates were better for women and, in general, Type 2 cases carried the best prognosis. Of the 1937-38 cases at least 57 patients survived fifteen years. Causes of death, ascertained in 141 instances, included uræmia 44 per cent., extra urogenital tuberculosis 15 per cent., and causes unrelated to the disease 12 per cent.

In comparing the collective series above (in which, with few exceptions, treatment with streptomycin and the newer drugs had not been given) with his recent personal series of 165 cases, Mr. Cosbie Ross first referred to the criteria of "cure" (or control) of the disease, stressing the importance of permanent conversion of the urine, absence of pyelographic and cystoscopic evidence of active disease, and the non-appearance of subsequent genital infection. By treating his cases with a combination of sanatorium régime, surgery when indicated, and full use of antibiotic and newer drugs, he was able to show a significant fall in the mortality rate (4.8 per cent. against 8.5 per cent. within three years), more instances of permanent conversion of the urine, a two-fold increase in the symptomatic and cystoscopic improvement, an absence of genital involvement subsequent to operation, and regular healing of surgical wounds by first intention. No marked alteration in the pyelographic appearances were observed in cases treated conservatively.

Finally, in discussing the controversial problems relating to the diagnosis and treatment of the disease the following comments were expressed:



- (a) Cystoscopy and pyelography are safe and necessary measures for accurate diagnosis.
- (b) Partial nephrectomy may be indicated in the presence of a diseased polar calyx with persistent organisms from the same ureter despite prolonged chemotherapy.
- (c) Nephrectomy, when indicated, should be performed at the optimum time, usually about two months after the institution of chemotherapy (unless urgent reasons contra-indicate delay).
- (d) Removal of the ureter (when performing nephrectomy) should be effected if thickening, fibrosis or stricture is present.
- (e) In general the newer drugs do not appear to alter the pyelographic outlines of the diseased kidneys.
- (f) Use of the newer drugs can only be considered as adjuvant to other methods of treatment.
- (g) The possibility of streptomycin inducing stricture formation in a previously diseased ureter cannot be excluded, but if used in combination with isoniazid the risk may be reduced.
- (h) Sanatorium care remains a necessity for the proper treatment of urinary tuberculosis.

Continuing the discussion Mr. J. G. Gow (Wrightington Hospital) reiterated the need for sanatorium treatment and gave details of the chemotherapy régime used by Mr. Cosbie Ross and himself. This consisted of fortnightly courses of streptomycin 2 G. and isoniazid 250 mgms. daily, alternating with fortnightly courses of T.B. 3 100-150 mgms. daily and Ca.B.PAS 7 G. t.d.s.—the courses continuing for at least six months. A domiciliary régime of treatment after discharge from the sanatorium was also in operation.

Dr. J. Colquhoun (Sheffield) discussed laboratory methods for the recognition of tubercle bacilli in the urine and referred to recent experimental work on the inhibition of intracellular bacilli by streptomycin.

Mr. M. F. Nicholls (London) in recounting his experience of genito-urinary infection in patients already suffering from bone and joint tuberculosis stressed the value of conservatism. Renal infection most commonly succeeded the development of a bone lesion and in many cases was asymptomatic. Routine examination of the urine in cases of orthopaedic tuberculosis brought to light a significant proportion of cases with minimal renal lesions, many of which appeared to heal without surgical intervention. Even in those cases in which the lesion progressed nephrectomy (20 in 66 cases) gave excellent long term results.

A full report on the discussion will be published shortly in the *British Journal of Urology*.

## WORLD HEALTH ORGANISATION

### SUMMARISED REPORT OF THE STUDY GROUP ON TUBERCULOSIS SIXTH WORLD HEALTH ASSEMBLY

THE public health administrator should consider tuberculosis first of all as an infectious disease, not merely as a social disease influenced by the general standard of living.

As human cases of tuberculosis are the main source of infection, and as in

man the extra-pulmonary forms play a minor role, emphasis should be placed on finding the pulmonary form of tuberculosis.

Since the infectious cases are of primary interest in the tuberculosis-control programme, the labelling of cases should be based on demonstration of tubercle bacilli and not merely on interpretation of a chest X-ray.

The need for reliable epidemiological data for planning and evaluating a programme is emphasised.

The tuberculosis dispensary, or, better termed, the "chest clinic," should be the centre for all aspects of tuberculosis control.

Emphasis should be placed on prevention; but this should, wherever possible, be combined with some sort of treatment. Mass B.C.G. vaccination is considered a useful tool, especially in countries with high prevalence of tuberculosis. Isolation of infectious cases, especially at night, is of greatest importance; and such isolation can be obtained not only in institutions, but also by other means, in or near the patient's home.

Every tuberculosis-control programme should be intimately connected with an educational programme, which—like the rest of the tuberculosis programme—should be integrated at the earliest possible stage into the general public health programme of the country.

#### INFLUENZA IN 1951-2

THE November issue of the Chronicle of the World Health Organisation contains a preliminary report from the World Influenza Centre, London, giving information concerning influenza in 1951-2. It reveals that, although there were scattered outbreaks in a number of widely separated places during the winter of 1951-2, there was no evidence of spread comparable to that of the 1950-1 epidemic. The viruses isolated in the two periods were also different: the majority of the 1950-1 strains were of the A-prime type, whereas all of the 35 strains received at the Centre during the winter of 1951-2 were influenza-B viruses. The latter were all closely related to one another serologically and to the Crawley (England, 1946) virus and were only distantly related to the Lee strain. Sixteen strains were received from Italy, 11 from the U.S.A., 3 from England, 2 from the Netherlands, and 1 each from Australia, Denmark and India.

Reports from South Africa show some influenza there during the early part of winter (May and June 1952). Six strains have been received from Cape Town and two from Johannesburg, all of A-prime type, Liverpool subtype.

*St. Thomas's Reports, Second Series. Vol. viii. 1952.*

Price 10s. 6d.

VOLUME VIII of the Second Series deals with a wide variety of contributions. The article on "Adenoma of the Trachea and Bronchi" by Barrett and Tomlinson is authoritative and beautifully illustrated. Our readers will also be interested in "The Assessment of Respiratory Function" by Dornhorst, who has contributed a useful analytical review on the whole subject.

Like its predecessors, the volume is very well produced and is a valuable addition to the literature.

MINISTRY OF NATIONAL INSURANCE  
REPORT ON PNEUMOCONIOSIS BY ADVISORY COUNCIL

THE Report\* by the Industrial Injuries Advisory Council on the method of prescribing pneumoconiosis as an industrial disease for which Industrial Injuries benefits can be paid, is now available.

The Council's recommendations are:

At present benefit for pneumoconiosis under the National Insurance (Industrial Injuries) Act can be paid only to persons who since July 5, 1948, have worked in certain occupations (known as scheduled occupations). The Report recommends that benefit should be made available to persons who have contracted the disease from other occupations in which they have worked since July 5, 1948. The Report also recommends that disablement benefit of 5s. 6d. a week should be paid in cases where the disablement from the disease has been assessed at between 1 and 10 per cent.; hitherto no benefit has been payable on an assessment of less than 5 per cent.

THE REGISTRAR-GENERAL'S STATISTICAL REVIEW  
OF ENGLAND AND WALES FOR THE TWO YEARS 1948-1949

THE Medical Text Volume of the Registrar-General's Statistical Review of England and Wales for the years 1948 and 1949† is primarily a commentary on the mortality and notification statistics of these two years, and many of the figures commented on have been published previously in Part I of the Statistical Reviews for the years concerned. It does not deal with the figures for later years already published in the Medical Tables volumes of the Annual Review or the Annual Reports of the Chief Medical Officer of the Ministry of Health. Separate volumes giving some results of morbidity enquiries will be published as Supplements to the Statistical Review for 1949. The following observations will be of interest to our readers:

*Low Death Rate in 1948*

The record low death rate of 11 per thousand for the year 1948 reflects exceptionally low rates in the first two quarters of the year, when there was a notable absence of influenza, a fact which had a beneficial influence on mortality from several other causes.

*Tuberculosis*

The year 1948 initiated the recent spectacular decline in tuberculosis mortality, but detailed figures for the years 1948 and 1949 record increases for respiratory tuberculosis among men aged 65 and over. The decline in mortality from other forms of tuberculosis was particularly great at lower ages.

*Cancer*

The years 1948 and 1949 showed no break in the almost steady rise in recent years in the crude death rate from cancer, but among women aged

\* Cmd. 8866, obtainable from H.M. Stationery Office, price 9d.

† The Registrar-General's Statistical Review of England and Wales for the two years 1948-1949, Text, Medical. H.M.S.O. Price 10s. net.

35-74 cancer mortality continued to show a definite downward trend. A large part of the male increase is due to the greater number of deaths attributed to cancer of the lung; for example, a death rate for this cause of 866 per million living at ages 55-64 in the years 1940-44 had reached levels of 1,520 in 1948 and 1,637 in 1949.

## NOTES AND NOTICES

### SKIN REACTIONS IN DOCTORS AND NURSES ADMINISTERING ANTIBIOTICS

RECENTLY the attention of the Ministry of Health was drawn to the fact that some district nurses had suffered from dermatitis after having given injections of streptomycin and penicillin to patients. Investigation showed that, while not common, the trouble did occur throughout the nursing profession both in and out of hospital and the following advice has therefore been issued.

It is realised that the technique here recommended following expert advice and *ad hoc* experiments, whilst in conformity with the practice of many doctors, differs markedly from that usually taught to nurses.

Urticaria of the face and hands is known to occur in a proportion of those who administer antibiotics by injection. It results from sensitisation produced by contact of the solution with the skin, and is believed to be caused much more often by streptomycin than by penicillin.

Contamination by the solution of the skin of both hands and face can readily occur when the syringe is held vertically at eye level and air expelled from it before injection: bubbles bursting at the tip of the needle then liberate a fine spray of the solution. In order to prevent sensitisation, this operation must not be conducted in this way. THE AIR SHOULD BE EXPELLED FROM THE SYRINGE WITH THE NEEDLE STILL IN THE BOTTLE FROM WHICH THE SOLUTION HAS BEEN WITHDRAWN. CARE SHOULD BE TAKEN TO SUPPORT THE PISTON DURING AND AFTER WITHDRAWAL SO THAT FURTHER AIR DOES NOT ENTER. Special care must be taken to ensure that the needle is firmly attached to the syringe so that no sudden leakage occurs under pressure.

Contamination of the hands with solution can still take place if the needle used for withdrawal is removed and another substituted for the injection into the patients. This is commonly done, either because a wide-bore needle facilitates withdrawal of viscous fluids, or because it is believed that perforation of the rubber cap blunts the needle. This belief is unfounded: it has been shown by experiment that piercing these rubber caps as many as 100 times does not affect the sharpness of the needle. The second precaution advised is therefore THAT THE SAME NEEDLE BE USED FOR BOTH WITHDRAWAL AND INJECTION. This is particularly necessary when giving streptomycin, and since this solution is not viscous, as fine a needle (*e.g.*, No. 14 or even No. 17) may be used as is desired.

After use the syringe should be rinsed out in plenty of water, and the doctor or nurse should then immediately wash the hands to rid them of any traces of solution left on them.

It must be remembered that these antibiotics are not the only possible causes of this type of skin affection, and any nurse developing it should consult her doctor at once in order that the cause may be found and the condition treated.

## N.A.P.T.

We have received the following publications on Tuberculosis in the Commonwealth:

*A New Colonial Vista*, which deals with the problem in general, and with the work of voluntary anti-tuberculosis associations.

*N.A.P.T. Commonwealth Scholarships*, a leaflet on the N.A.P.T. Scholarship scheme, which enables numbers of Commonwealth doctors, nurses and health officers to come to England to study the latest methods of tuberculosis control.

*Tuberculosis—A Commonwealth Problem*, a résumé in a condensed and handy form of the papers on Tuberculosis in the Commonwealth, read at the Third Commonwealth Conference in London in 1952 and published in full in the Transactions.

## ROYAL SANITARY INSTITUTE

DR. H. C. MAURICE WILLIAMS, O.B.E., has been elected Chairman of Council of the Royal Sanitary Institute from October 1, 1953. Dr. Williams is Medical Officer of Health to the County Borough and Port of Southampton, a Past President of the Society of Medical Officers of Health, and the Honorary Secretary of the Association of Sea and Air Port Health Authorities.

## CANADIAN TUBERCULOSIS ASSOCIATION

DR. J. A. VIDAL has been elected President for the coming year.

At the recent Convention papers were read by Dr. T. Gedde-Dahl of Oslo and Dr. J. Burns Amberson of Bellevue Hospital, New York.

Among Canadian contributors there were papers by Dr. Hugh E. Burke on tomography in tuberculosis of the spine; Dr. Frederick Dubskey on the use of tomography in the detection of chest disease; Dr. A. W. Capon on the combined use of isoniazid, streptomycin and P.A.S. for the treatment of pulmonary tuberculosis.

There were several papers on lung surgery, tuberculous meningitis, and a report on the laryngeal swab technique in the evaluation of activity in minimum pulmonary tuberculosis. A paper on the bronchographic and pathological findings in pulmonary tuberculosis was given by Drs. Paul Rabinowitz and A. R. Armstrong.

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